Natural History Museum Library
000196232

THE LONDON NATURALIST

The journal of the
LONDON NATURAL HISTORY SOCIETY

No 66

Published 1987
Price £4.00

LONDON NATURAL HISTORY SOCIETY

The Society welcomes new members, both beginners and experts. Its Area lies within a 20-mile (32 km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology or rambling, there is a section ready to help.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area, including records of plants and animals.

The *London Bird Report,* also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter* and the *Ornithological Bulletin,* are sent to members throughout the year.

Indoor meetings

These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

Field meetings

Led by experts to visit interesting natural history localities, many outside our Area. These excursions are very popular with beginners wishing to increase their knowledge and enable members to get to know one another.

Library

A large selection of books and journals on most aspects of natural history is available for loan or consultation by members free of charge.

Reading circles

Many important natural history journals are circulated by the sections at a fraction of the cost of subscribing direct.

SUBSCRIPTIONS

ORDINARY MEMBERS	£6.00
JUNIOR MEMBERS	£3.00
SENIOR MEMBERS	£3.00
FAMILY MEMBERS	£1.25
SUBSCRIBER MEMBERS	£6.00

The entrance fee is £0.50. Junior membership is for persons under 18, or under 25 and receiving full-time education, and senior membership is for persons over 65 who have been continuous members of the Society for ten complete years. All except family members receive one free copy of *The London Naturalist* and the *London Bird Report* each year. Cheques and postal orders, payable to the London Natural History Society, should be sent to:

The Membership Secretary, P. C. Holland,
Flat 9, Pinewood Court, 23 Clarence Avenue,
London, SW4 8LB

THE LONDON NATURALIST

Back numbers of *The London Naturalist* are available as follows:
No. **39** (1960) — **47** (1968), **49** (1970) — **52** (1973): £1 each. No. **48** (1969): £0.50. No. **53** (1974) — **54** (1975): £1.50. No. **55** (1976) — **58** (1979): £2.50. No. **59** (1980) — No. **65** (1986): £3.

These, and back numbers of the *London Bird Report,* may be obtained from the Publications Sales Secretary, Mrs J. M. Short, Upper Flat, 65 Arthur Road, London SW19 7DN. Reprints of the Index to *The London Naturalist* **32** — **51** are available for £0.25 post free. Reprints of the *Annual Rainfall Overlay, Master Grid Overlay, Habitat Overlay, Regolith Overlay* and *Air Pollution Overlay* are free on receipt of a stamped addressed envelope.

THE
LONDON
NATURALIST

The journal of the
LONDON NATURAL HISTORY SOCIETY

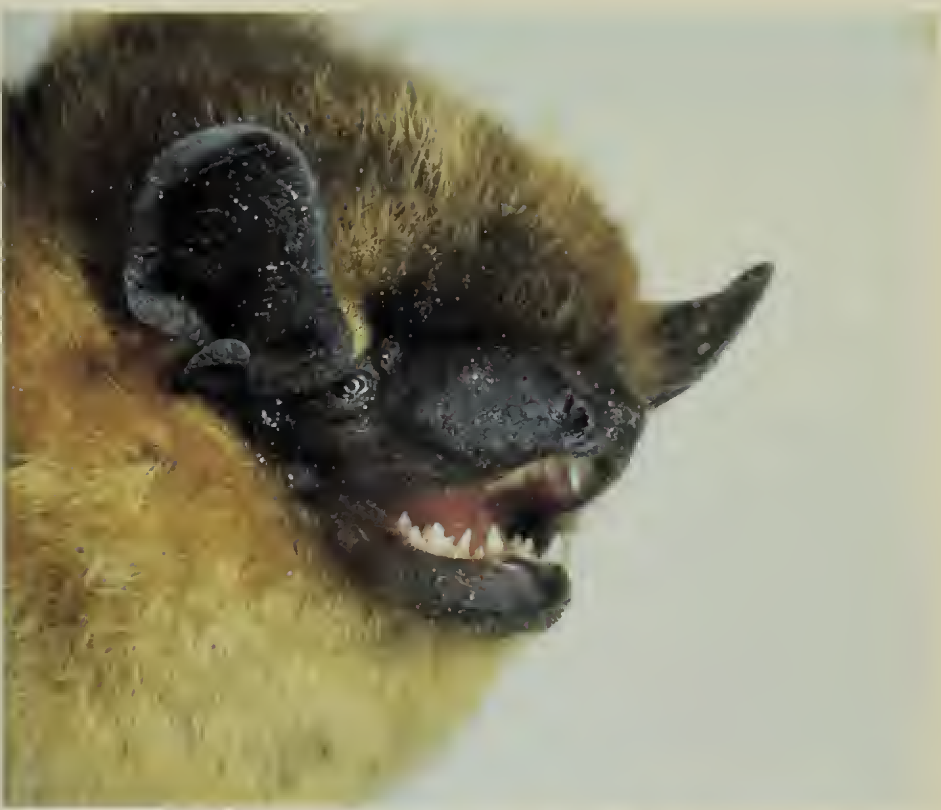
No. 66

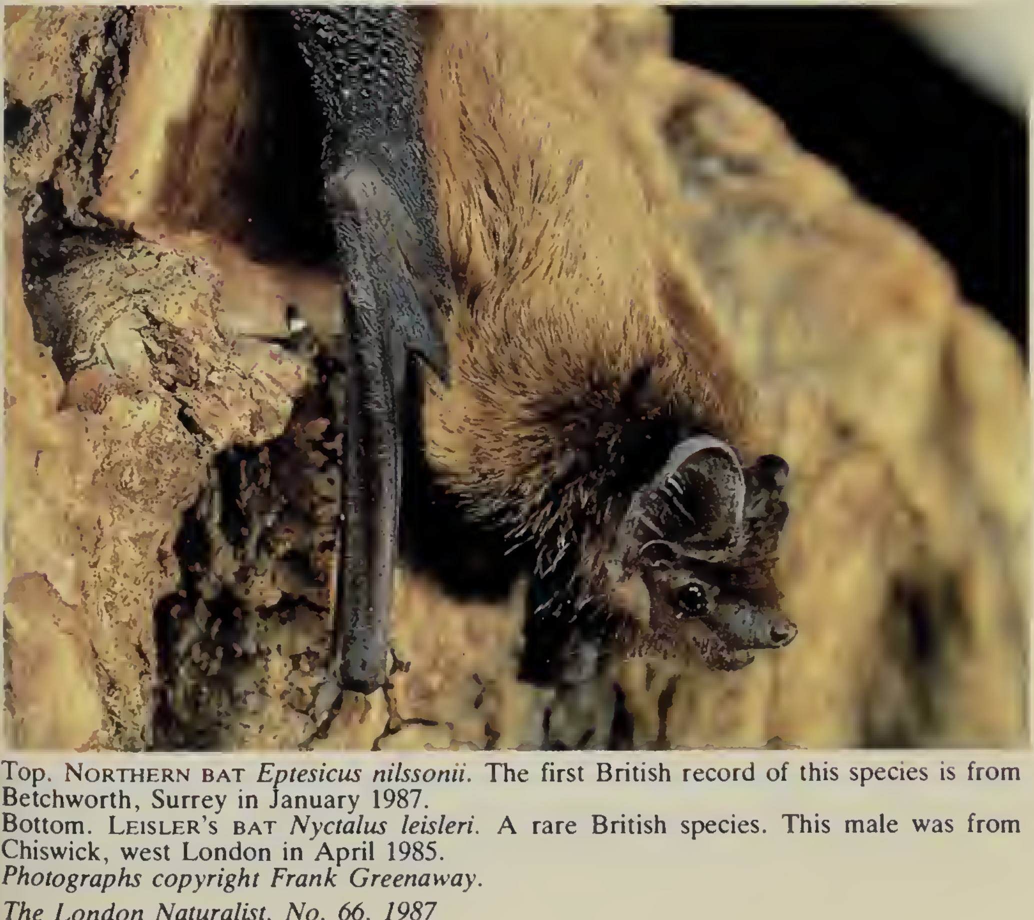
for the year 1986

Edited by K. H. Hyatt

ISSN 0076-0579
World List abbreviation: *Lond. Nat.*

Published November 1987
© London Natural History Society 1987, London
Printed by Echo Press (1983) Ltd., 25 Swan Street, Loughborough, LE11 0BT
and at Temple Chambers, Temple Avenue, London EC4Y 0DT.





Top. NORTHERN BAT *Eptesicus nilssonii*. The first British record of this species is from Betchworth, Surrey in January 1987.
Bottom. LEISLER'S BAT *Nyctalus leisleri*. A rare British species. This male was from Chiswick, west London in April 1985.
Photographs copyright Frank Greenaway.

The London Naturalist, No. 66, 1987

LONDON NATURAL HISTORY SOCIETY

Founded 1858

President

H. M. V. Wilsdon, M.B.O.U.
79 Mill Rise, Westdene, Brighton, East Sussex BN1 5GJ

Honorary Vice-Presidents

E. B. Bangerter, F.L.S., G. Beven, M.D., B.SC., F.Z.S., M.B.O.U., Miss E. Brown, B. L. J. Byerley, F.R.E.S., B. Campbell, PH.D., †S. Cramp, O.B.E., B.A., F.Z.S., M.B.O.U., R. W. Hale, Miss E. M. Hillman, B.SC., P. C. Holland, Eric Hosking, O.B.E., F.R.P.S., M.B.O.U., Miss C. E. Longfield, F.R.G.S., F.R.E.S., M.B.O.U., E. M. Nicholson, C.B., C.V.O., LL.D., M.B.O.U., R. M. Payne, F.R.E.S., Mrs L. M. P. Small, ††Prof E. H. Warmington, M.A., F.R.HIST.S.

†Deceased August 1987. ††Deceased June 1987.

Officers for 1987

Vice-Presidents: A. J. Barrett, K. F. Betton, M.B.O.U., R. M. Burton, B.A., R. E. Butler, B.SC., F.G.S., V. F. Hancock, M.B.O.U., K. H. Hyatt, C. W. Plant, B.SC.

Secretary: Miss C. M. Balfour, 8 Crossfield Road, London NW3 4NS.

Treasurer: J. H. Sand, F.C.A., 19 Brett House, Putney Heath Lane, London SW15 3JE.

Membership Secretary: P. C. Holland, Flat 9, Pinewood Court, 23 Clarence Avenue, London SW4 8LB.

Library Secretary: J. Barrington, c/o Lyon Playfair Library, Imperial College, London SW7 2AZ.

Publications Sales Secretary: Mrs J. M. Short, Upper Flat, 65 Arthur Road, London SW19 7DN.

Editor, *The London Naturalist:* K. H. Hyatt, Dept. of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD.

Editor, *London Bird Report:* A. V. Moon, Chalkdell House, London Road, Rickmansworth, Herts. WD3 1JP.

Editor, *Newsletter:* Miss L. Philpott, First Floor Flat, 83 Western Road, London NW5 5DT.

Elected Members of Council: D. Bevan, R. A. Husband, A. L. Lapworth, B.A., A.L.A., J. E. D. Milner, M. West.

Representative Members of Council: Botany – Miss E. Young, Ecology and Entomology – C. B. Ashby, Geology – R. V. Goulding, Ornithology – M. J. Earp, Ramblers and Archaeology – Miss D. E. Woods, South-West Middlesex – Miss H. M. Smith.

The Society's Recorders

Botany

Flowering plants and vascular cryptogams:
R. M. Burton, B.A.,
Sparepenny Cottage,
Sparepenny Lane,
Eynsford, Kent DA4 0JJ

Bryophytes:
Dr K. J. Adams,
63 Wroths Path,
Baldwins Hill,
Loughton, Essex IG10 1SH

Ecology and Entomology

Mammals:
R. V. Goulding,
239A Carr Road,
Northolt, Middlesex UB5 4RL
01-864 0759 (Also recorder for the London Bat Group)

Reptiles and Amphibians:
T. Langton,
c/o Fauna and Flora Preservation Society,
8-12 Camden High Street,
London NW1
01-387 9656

Mollusca:
F. C. Naggs,
c/o Department of Zoology,
British Museum (Natural History),
London SW7 5BD

Dragonflies:
S. J. Brooks,
4 Nelson Road,
London N8 9RU
01-341 0773

Mammals (Bats):
S. Mickleburgh,
c/o Fauna and Flora Preservation Society,
8-12 Camden High Street,
London NW1 01-387 9656

Fishes:
A. C. Wheeler,
c/o Department of Zoology,
British Museum (Natural History),
London SW7 5BD

Butterflies, moths, invertebrates not listed elsewhere:
C. W. Plant, B.SC., M.B.O.U., F.R.E.S.,
14 West Road,
Bishop's Stortford,
Hertfordshire CM23 3QP
0279 507697

Spiders and other arachnids:
J. E. D. Milner,
80 Weston Park,
London N8 9TB
01-340 2619

Ornithology

Buckinghamshire:
A. M. Haig,
686 Whitton Avenue West,
Northolt,
Middlesex UB5 4LA

Kent and Lower Thames (London Bridge downstream):
A. J. Morris,
134 Station Road,
Crayford,
Kent DA1 3QQ

Essex:
J. Fitzpatrick,
18 Edwick Court,
High Street,
Cheshunt, Hertfordshire EN8 0AB

Inner London:
D. Boyd,
14 Busden's Lane,
Milford, Godalming,
Surrey GU8 5JR

Hertfordshire:
G. J. White,
36 Rye Road,
Hoddesdon,
Hertfordshire EN11 0HR

Surrey and Upper Thames:
R. B. Hastings,
33 Bracken Gardens,
London SW13 9HW

Middlesex:
P. Naylor,
27 West Common Road,
Uxbridge,
Middlesex UB8 1NZ

Geology

Mrs. D. J. Goulding,
239A Carr Road,
Northolt, Middlesex UB5 4RL

General enquiries
J. F. P. Bennett (Secretary of the Records Committee),
7 Clifton Road,
Watford, Hertfordshire WD1 8DH

Recording forms are available from John Bennett (s.a.c. please). Records may be sent to the appropriate recorder or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Requests for information should be made to the appropriate recorder or to John Bennett.

Contents

Northern Bat and Leisler's Bat .... *Frontispiece*

Officers for 1987 3

The Society's Recorders 4

Report of the Society for 1986 6

Recording London's wildlife — COLIN W. PLANT 7

Past conservation and management in Epping Forest — R. L. LAYTON 13

The field layer of Perivale Wood — NIC FERRIDAY 23

Hedgerows surviving in suburban Kingsbury — L. R. WILLIAMS, J. MCLAUCHLIN and T. G. HARRISON 35

Distribution and status of bats in the London area — SIMON MICKLEBURGH 41

Some observations on the fauna and flora of Nine Elms, Battersea, before the development of London's New Covent Garden Market — W. G. TEAGLE 92

A new list of spiders found in London — J. E. D. MILNER 101

Spiders in Alexandra Park 1984-7 — J. E. D. MILNER 111

The butterflies of London's East End: a three-year survey — DAVID MURDOCH, TERRY LYLE and M. J. G. HOLMES 125

A review of the Lepidoptera of the London area for 1985 and 1986 — COLIN W. PLANT 135

Survey of Bookham Common: Forty-fifth year
Progress report for 1986 157

Population dynamics of damselflies at Bookham Common — RUTH DAY 167

Botanical records for 1986 — R. M. BURTON 185

Obituaries:
EDWARD CHARLES WALLACE, 1909-1986 190
BARBARA WELCH, 1904-1986 190
HARRY ASHLEY TOOMBS, 1909-1987 191

Income and expenditure account for the year ended 30 June 1986 194

The Society's recording areas overlay — KEITH H. HYATT 196

Book reviews 12, 21, 22, 33, 34, 40, 91, 110, 134, 156, 166

Report of the Society for 1986*

Following the purchase of the computer mentioned in last year's report, it is now being used by the recorders for the storage and retrieval of records. The membership list has also been put on it and it is hoped to link this with a mailing system.

In order to allow important research on bats in the London area to continue after the demise of the G.L.C., the Society made a grant of £2,500 until alternative funding was settled. The results of this research will be published in *The London Naturalist* and it is hoped that a more popular booklet can also be published.

Elsewhere, work on the recording side continues to develop. Recording for the butterfly atlas is now virtually complete and it is hoped that it will be published next year. On the ecology and entomology side, there are now seven recorders, working on 6 groups of invertebrates and 3 of vertebrates. Work on the Bookham Common Survey continues; some observations have been made of pond life and a new project on the distribution of vascular plants has been initiated.

Work on ornithological recording has concentrated on surveys begun in earlier years rather than on starting new ones. The Society helped with a national survey of wintering cormorants which took place between September 1985 and April 1986. Monthly counts were arranged and 58 sites in the London area were covered. Work on the Woodland Bird Survey continues and attempts were made to cover areas previously missed. Some pilot work on a survey of birds of Inner London was undertaken.

This year saw the 50th issue of the *London Bird Report* and this coincided with a conference in October held jointly with the B.T.O. The theme was 'Fifty Years of London Birdwatching' and 'Winter Birds'.

The Sections have again organised a full and varied programme of meetings. The geological Section has been re-started under the enthusiastic leadership of Richard Goulding. There was a series of indoor meetings, a large proportion of which was followed by a related field meeting. The programme is to be stepped up in 1987. This pattern of linked indoor and field meetings was also followed on some occasions by the Ecology and Entomology Section. That Section has also established a series of 'state of the art' lectures on current research topics, called the Parmenter Lectures. The Ramblers and Archaeology Section has consolidated the widening of its interests, with inclusion of archaeology and geology topics in their meetings. Attendances at meetings were in some cases a little down on last year, although the coach trips organized by the Ornithology Section were well patronised.

In the absence of any mail shots, we enrolled only 164 new members in the year to 30 September 1986, compared with 265 for the same period a year earlier. The figure of 164 was offset by losses from deaths, resignations and removals for non-payment, leaving the total virtually unchanged. Fourteen deaths were reported: Mrs M. L. Robertson, R. S. Dadson, R. A. Boniface, S. E. Ellis, D. Carr, R. S. W. Pollard, G. E. Manser (a member of very long standing), Mrs E. M. P. Dumler, S. J. Clodd, E. C. Wallace (formerly the bryophyte recorder for many years), R. F. Cosser, Miss W. V. Robinson, J. C. Phipps, and Sir Malcolm George Wilcox.

The membership figures are as follows:

	30 Sept. 1986	*30 Sept. 1985*
Ordinary	1,345	*1,069*
Family		*150*
Junior		*40*
Senior		*82*
Honorary	17	*17*
Life	8	*8*
Affiliated	17	*22*
Total	1,387	*1,388*

Our thanks go to all officers and sectional committees who have worked hard for the Society. Thanks also go to Imperial College for the use of their rooms and a particular tribute is due to Mr Whitworth, of the Lyon Playfair Library, who retired this year, for all he has done for the Society's library.

*Presented at the Annual General Meeting, 9 December 1986.

Recording London's Wildlife

by Colin W. Plant

(Presidential Address delivered at the Annual General Meeting on 9 December 1986)

Introduction

First of all I must define what I mean by London. The earliest published reference to 'the London area' by this Society appears to have been made in 1899, when Buckell and Prout, acting upon the direction of Council, published the first part of their list of the butterflies and moths of London in *Proceedings and Transactions of the City of London Entomological and Natural History Society* – a journal to be renamed in 1914 as the *Transactions of the London Natural History Society* when the City of London Society joined forces with the North London Natural History Society to form the organisation to which we here belong. The area chosen by Buckell and Prout was a circle of ten-mile radius centred upon Charing Cross Station. This choice of centre was no accident: indeed the whole boundary of the ten-mile circle was delineated by railway stations, for the train was the best, and often only, means of transport that naturalists could use to gain access to the outlying parts of the Capital.

Members will of course be aware that this Society's present recording area is based upon the circle which extends at radius 20 miles (32 kilometres) around St Paul's Cathedral (a slightly more accurate centre than Charing Cross Station), although the actual boundary follows the Ordnance Survey's grid lines around the tetrads crossed by this circle. This large area includes all of Middlesex (vice-county 21), large chunks of rural West Kent (vc 16), Surrey (vc 17), and South Essex (vc 18), as well as smaller chunks of North Essex (vc 19) and Hertfordshire (vc 20), and a minuscule portion of Buckinghamshire (vc 24). It covers all of the London Boroughs. In recent years there has been some criticism of this choice of area, principally on the grounds that much of the outer zone can not really be referred to as 'London'. Whilst this may be strictly true, this extended area does allow for an examination and comparison of three major environmental zones: the green belt, the urban fringe, and London itself, and indeed this is the area which I shall be referring to this evening. Furthermore, it allows for a comparison of present-day results with those obtained by earlier workers over the same area, and I would be very much against any reduction in the size of the circle for this reason. (I cannot help but wonder whether Buckell and Prout were equally criticised for including in their circle many areas of rural countryside, such as, for example, the Hammersmith Marshes, the flower-rich meadows along the River Lea in Hackney and Walthamstow or the farmland in Lewisham!). Having said this however, I do believe that there is much to be gained from a study of the truly urban parts of London, and am reminded that we do indeed mark an area in the middle of our circle and call it 'Inner London'. This area, which is always referred to separately in the various reports published by the Society's Recorders, even though it contains parts of two separate vice-counties (Middlesex and Surrey), was established in 1929 by A. Holte MacPherson who, for the purpose of a paper entitled 'A List of the Birds of Inner London' published in *British Birds* during March of that year, defined 'an oblong area: the centres of the upper and lower boundaries being two and a half miles due north and due south of Charing Cross, and those of the two sides four miles due east and due west of that point'. Whilst it is true that much of the area outside this arbitrary rectangle is equally urban in character, the retention of the original boundary again allows for a comparison of results, and a reflection of the changes in wildlife composition in the truly urban area of London over the years.

It is of importance to note that various other organisations to which I shall be referring are not so geographically wide-reaching in their activities. The Greater London Ecology Unit, successor to the now abolished Greater London Council's Ecology Section, covers, for reasons of funding, only the thirty-three London Boroughs of the former G.L.C. area (and even then only those subscribing to the London Boroughs Joint Ecology Committee, which therefore excludes those boroughs currently administered by the Conservative Party).

Within the London area as presently defined there are a number of smaller organisations which contribute much to our knowledge of wildlife in the Capital. Some of the more scientifically orientated ones include, for example, The Croydon Natural History and Scientific Society in Surrey, the Ruislip and District Natural History Society in Middlesex and the Wren Conservation Group in South Essex. Arachnologists, apparently, regard London as being the old London County Council area for recording purposes, which has a yet different boundary.

My definition of wildlife is less easy. I initially decided that this would include all living organisms which occur, or have occurred, within the London area, with the exception of Protozoa, bacteria, viruses and fungi not included in the three principal divisions of Myxomycota, Ascomycotina or Basidiomycotina. Then I remembered things such as plant galls, many of which are bacterial or fungal in terms of their causative agent. So in the end I decided that it was best to include everything: would anyone willing to record mycoplasmas on behalf of the Society please step forward?! Of course, even amongst larger organisms some groups will inevitably be better recorded than others. Birds, for example, are particularly popular, echinoderms or coelenterates perhaps less so. The choice of which particular groups of wildlife are singled out for recording and study by an individual (or a society) however, will of course hinge largely upon the reason for recording. This is perhaps the most fundamental question, and yet the one to which we rarely, perhaps never, address ourselves. Why do we record wildlife?

I would suggest that there are two basic reasons. The first, and perhaps the most important one from the point of view of the amateur, is one of personal enjoyment! An enormous number of people, myself included, derive a considerable amount of pleasure from the involvement of wildlife in their leisure activities, and, largely because natural history to a great extent is still an amateur activity in this country, the facilities exist for those who wish to make a contribution to the published store of knowledge to do so. And after all, there is nothing like seeing your name in print to stimulate you to do more!

The second reason for recording is a more fundamental one: it is simply that there may be a need for the information gathered as a result. This need can manifest itself in several ways: wildlife conservation, site conservation, habitat creation, management of environmental resources, and pest control spring instantly to mind – and there are other equally justifiable reasons which I have omitted to mention. Equally there may be needs which have not yet arisen, but for which an accumulation of earlier data would prove invaluable.

What form does recording take and who does it?

The earliest form of wildlife recording was no doubt carried out by early man, who would have mentally recorded the locations of herds of animals which could be captured and eaten. This information would have been passed from father to son in the course of human survival. Later in our history the Normans, with their passion for hunting, kept meticulous records of places where deer, wild boar and other species could be hunted with ease. 'Modern' species recording however probably began in the Victorian era, and has continued and is maintained by present day natural history societies, including our own. Essentially this involves keeping a written record of the locations of a particular species, together, hopefully, with a note of when they were seen. Such traditional recording is relatively easy to do. All one requires, in addition to a knowledge of the taxonomic group under study, is a pencil and a set of record cards. Records can also be spotted directly on to maps at a variety of scales to build up a picture of distribution for a given species. Such activity gathered momentum during the 1960s following the Botanical Society of the British Isles's Plant Mapping Scheme and the later formation of the National Biological Records Centre at Monks Wood in Cambridgeshire. The latter institution has since then produced innumerable publications showing the distributions of a great variety of species from the popular to the not so popular, and this has established an immensly important base line of information which can be used to assess whether the presence of a particular species in a particular area is noteworthy or otherwise.

Useful though this work is however, its value in present-day conservation is rather more limited than it was say twenty years ago. The image of wildlife recording generally is changing from one of amateurs recording local distributions, contributing their data to professionals and others recording nationally, to one of *site* assessment, whereby the species content of discreet sites is listed and evaluated for pure conservation reasons. That is not to say that distribution recording is dead! Far from it, for it is essential to learn as much as possible about the ranges, and distributions within those ranges, of every species which is to be used in any way for site assessment. We can not state that a site contains rare birds unless we know that the birds are in fact rare. (We probably need to define the term 'rare' as well somewhere!)

However, site assessment is a far more involved activity than simple distribution recording. No longer can the task be carried out by the amateur working at home from a card index. A much more extensive filing system is required, and this involves a considerable expense in terms of time and money, as well as a greater degree of coordination of effort on the part of taxonomic specialists. The question I wish to raise therefore is whether or not a local natural history society such as ours should be as actively involved in site assessment as it is in distribution recording work, and in order to answer this question it may be helpful to examine the situation elsewhere in the country, before taking a closer look at the London area.

The importance of proper site assessment was recognised several years ago quite independently by a number of people, and during the early part of the 1970s attempts were made to tackle the problems inherent in a system designed to deal with recording at the national level by the establishment of Local Biological Records Centres. These usually operated on a county basis, and for convenience were normally based in the county natural history museum. Whilst still recording distribution of species on the basis of the ten-kilometre square, theoretically communicating data to the National Biological Records Centre at Monks Wood, their smaller area of operations allowed them to embark upon far more detailed surveys. For many this meant mapping the flora and fauna of their area on a tetrad basis, or, as in Essex and elsewhere, on the basis of monads (one kilometre squares). The value of using monads is quite clear for example, when recording Odonata, as the distribution map of the banded demoiselle *Calopteryx splendens* (Harris) demonstrates. The pattern of distribution not only shows this to be a riverine species, but tells us also fairly precisely where on each river in the county the insect is to be seen. This in turn tells us that it is an insect of slower flowing stretches, typically with muddy bottoms and overhanging trees and other vegetation. Straight away therefore we can advise the river authority of potential measures for the conservation of this species. None of this is possible from the ten-kilometre distribution maps (perhaps not from tetrads either). The activities of these Local Biological Records Centres are now coordinated and supported by a relatively new body called the National Federation for Biological Recording (N.F.B.R.) – a body to which I believe this Society should also affiliate.

Most Local Records Centres, however, also embarked upon true site surveys. Typically this would involve the creation of a paper file in a cabinet, labelled with the site name, and filled with various species recording cards supplied from

Monks Wood. Thus it became a far easier and more rapid task to produce a composite species list for each site, whilst still having the facility to temporarily withdraw cards from the file in order to transfer the data to distribution maps.

This is a sytem operated by many of the Local Biological Records Centres in Britain today. However, it is a system which requires a lot of space for filing cabinets, whilst the sheer volume of species recorded from a given site, if surveyed at all properly, make it essential to employ full-time staff. Disney (1986) calculated that even with one thousand active recorders (which we certainly fall well short of) it would take 2,404 years to map properly the dipteran fauna of the United Kingdom! To produce comprehensive lists for all the sites in the London area would probably take a little longer!

However, modern technology has now come to the rescue in the form of the micro-computer. Although there is not yet a computer programme capable of performing the identification of insects, the saving on time and space in the storage and handling of records is tremendous. Whilst the initial purchase cost of such equipment is comparatively high, the saving on the costs of record cards and filing cabinets probably covers this in a comparatively short space of time. The speed of operation of most micro-computers today means that data can be retrieved, sorted, printed and sent to an enquirer within a single working day in many cases: the value of this when dealing with sites under threat is quite obvious. If the enquirer also has a compatible computer, then data can even be transferred down a telephone line saving even more time. The L.N.H.S. has had two Apricot micro-computers for a year now, and these are more than proving their worth, although it will be a long time before the backlog of records can be entered. When it is done however we should have an extremely valuable species data base and be able to respond to requests for information on named sites very rapidly.

What then is the current situation in the London area? There are after all a very large number of people and organisations interested in this area, and there is a clear need for site conservation work here. As more and more land is required for roads, housing and industry the need to decide which bits should be sacrificed and which should be saved becomes pressing. A number of organisations could be usefully mentioned here.

National bodies, such as the British Trust for Ornithology, have a clear overlap of interest with our own Ornithology Section, through surveys such as the Common Bird Census, Cormorant Survey, Heron Survey, Winter Atlas and so on. Our own Woodland Birds Survey, as well as other activities, overlap in the opposite direction, and this, the Common Bird Census and other surveys are indeed site related. They should, if readily and freely available to those who need the data, provide much useful background for site conservation. But this is only birds, and it would be quite illogical to preserve a site for one species group without any thought whatsoever for other organisms. I wonder how many sites have been cleared of scrub to preserve orchids or butterflies on chalk downland without first conducting a breeding bird survey?

On a more local level, during their final years the Greater London Council established an Ecology Section. Here for the first time ever in what is this Country's capital city, we had a full-time body of professionals dedicated to ecological survey and assessment of sites within Greater London. Their commissioning, during 1984, of a phase one habitat survey of Greater London (carried out by ecologists on contract), has provided an extremely important reservoir of information on sites of ecological interest in the London area, and one which is now being added to and acted upon by their successor following abolition of the G.L.C., the Greater London Ecology Unit (G.L.E.U.). This they are doing by means of detailed surveys of the sites in individual London Boroughs, and by specific surveys into the distribution of habitat types, such as woodland, and neutral grassland. Further, the existence of a conservation body, in the form of the London Wildlife Trust, should allow for proper use of the ecological data for site and species conservation in Greater London.

On an even more local level, there are a number of local natural history societies active in the London area, and many of these produce quite excellent local reports and journals containing information on the wildlife of their particular areas.

Our Way Ahead

What then of the L.N.H.S.? Do we really still have a role to play in this activity, or should we retire gracefully to the sidelines in the knowledge that the data we have gathered over the years are safe in the hand of others who have both the power and the ability to use them.

It seems quite clear to me in fact that the L.N.H.S. still has a number of very important roles to play in recording London's wildlife. Without wishing to criticise in any way the extremely valuable work of G.L.E.U., it is important to note that their emphasis is on phase one survey only, and this only on the basis of the botanical communities at each site. The aim of their work is to locate potentially valuable areas of land, examine the floral community, and assess the site on this basis. No species lists, not even of the plants, are compiled (although note is made of anything obvious), nor are detailed vegetation maps drawn up. The Unit's recent surveys of woodland and neutral grassland in London are naturally a little more detailed, but even here only the dominant species of plants are recorded and many less common elements are not even looked for. As I have said, this is in no way a criticism of the work of the Unit. They continue to achieve their stated objectives, and have no intention to even contemplate species listings for any sites.

This Society should therefore, in my opinion, set itself about the task of recording *all* forms of wildlife at various discrete sites, including those designated as important by G.L.E.U., in addition to continuing with its valuable work on the general distribution of species, which has resulted in works such as the *Atlas of Breeding Birds of the London Area* and *Flora of the London Area*. Further, I feel we should embark upon our own phase one survey of sites beyond Greater London but within the twenty-mile circle which is our own recording area, and having identified the better sites here, set about producing fuller species listings for them also. We certainly have the expertise to carry this out, a fact clearly demonstrated by the results from the survey of Bookham Common. Now, we have the technology to allow us to increase our coverage, which can only be to the overall advantage of wildlife conservation in our area. Perhaps we should also consider setting up local groups along the lines of our thriving South-West Middlesex Section, but with an emphasis on field work? I would certainly welcome any assistance from members in the Essex quarter for which I am professionally responsible.

Site evaluation has traditionally relied on vegetation surveys, so perhaps our botanists might wish to consider producing detailed vegetation maps for sites of importance.

There is now a great deal of evidence to indicate that some sites found to be poor in terms of their floral diversity score unexpectedly high in terms of their invertebrate faunas, and I do believe that we could do far worse than concentrate a good deal of our efforts on proper site surveys of invertebrates. Certainly there will be a continuing need to assess the distributions and status of as many species as possible, and to monitor the changes in these, and this will become particularly important in respect of invertebrates as data from the Nature Conservancy Council's *Invertebrate Sites Register* becomes more widely available. I am confident that the time will come in the very near future when it will be possible to designate sites in the London area as being worthy of protection on the basis of their invertebrate fauna alone.

In this respect as well as in other areas, we have an important role to play in coordinating the efforts of other smaller, and probably less financially fortunate societies, by offering them the use of our computer facilities to store and analyse data, by providing a specimen identification service where appropriate, by the offering of space in our two journals for the publication of their results and by the provision of funding if appropriate.

As an example of the last suggestion we have already provided financial support for research into London's bats. The establishment of the post of 'London Bat Officer' within the Fauna and Flora Preservation Society (F.F.P.S.), to conduct research into the distribution, biology and conservation of Chiroptera in Greater London, was made possible by grant-aid given by the Greater London Council. Following the abolition of this body in 1986, the L.N.H.S. provided the funding to enable the post to continue until a more permanent source of finance became available. This further allowed the F.F.P.S. to extend the activities of the London Bat Officer to cover the remainder of the 'London Area' beyond the former G.L.C. boundary, and allowed the L.N.H.S., through the establishment of a London Bat Project Steering Group, to steer the research in a specific direction. Preliminary results of this extremely valuable work are being published in the 1987 issue of *The London Naturalist,* whilst the L.N.H.S. Council proposes the publication of a popular booklet on urban bats, based upon the results of L.N.H.S.-funded research in London.

This of course introduces yet another very important activity in which the L.N.H.S. is the leader: the publication of papers and notes relating to London's natural history in its two journals *The London Naturalist* and *London Bird Report.* This year, 1986, has seen the fiftieth anniversary issue of the latter work, whilst *The London Naturalist* has been steadily increasing in size over the last few years, indicating the continuing interest in this aspect of the Society's work. It is worth reminding members that the pages of these journals are open to contributions from members and non-members alike, and it is the subtle blend of professional and amateur contributions which makes these journals informative, authoritative and yet still very readable.

I hope then that I have convinced you that we still have a great deal to do in the field of wildlife recording in London, and that far from diminishing our importance, the recent emergence of professional recording organisations in parts of our area has shown us quite clearly where our responsibilities lie. I regard this as an exciting challenge, and I hope that you will join me in rising to it.

Reference

DISNEY, R. H. L. 1986. Inventory surveys of insect faunas – discussion of a particular attempt. *Antenna.* **10:** 112-116.

Book Review

Woodlice in Britain and Ireland: Distribution and Habitat. By Paul T. Harding and Stephen L. Sutton. Institute of Terrestrial Ecology, 1985. 151 pp. £5.50 including postage and packing. ISBN 0 894282 85 6.

This very useful and reasonably priced book deals with both distribution and habitat of these arthropods in great detail as the title implies. The reviewer found it refreshing that European species were not introduced as is the case in so many natural history books nowadays and therefore the reader does not need to wade through numerous irrelevancies.

There is a handy and comprehensive checklist and nomenclature, and excellent distribution maps. A useful but not comprehensive glossary is included together with a list of references and notes concerning completing Record Cards. All these features combine to make this a very acceptable little book.

R. V. Goulding

Past Conservation and Management in Epping Forest

by R. L. Layton*

Summary

In the past, as today, the issue of landscape preservation and conservation can be controversial and lead to heated debate at national or local level. Epping Forest is an area that has had its fair share of such controversies over landscape management. Early management proposals, and the public reaction to them, throw light on some of the concerns felt in the past and put today's conflict into perspective.

The saving of Epping Forest, under the Epping Forest Act, 1878, arose out of the nineteenth-century desire to preserve open spaces for recreation. This general movement overcame a determined effort on the part of some individuals to enclose common land. Amongst the earliest commons saved were Hampstead Heath (1868), Berkhampstead Common (1870), Tooting, Wimbledon and Wandsworth Commons (1871) and Epping Forest (1878). Although Epping Forest was not the first open space to be saved from enclosure, it has been argued that there has never been a commoners' case of such magnitude involving so many interests or so wide reaching in the effect of the issues determined (Lord Eversley 1910).

The Epping Forest Act made the Corporation of London Conservators of the Forest. The Corporation was given specific guidelines including keeping the Forest unenclosed as an open space for recreation, granting the public the right to use it and preserving the natural aspect of the Forest. The Act also terminated all rights of pollarding but allowed the common use of pasture and pannage to continue while the right to dig gravel became subject to the provisions of the Act.

When the Conservators took over the management of the Forest a number of schemes were initiated. An early priority was the restoration of the Forest from what was seen as centuries of neglect. During the nineteenth century a considerable amount of land had been enclosed and some put under the plough. An attempt was subsequently made by the Conservators to flatten some of the residual ridge and furrow features and remove the remaining enclosure boundaries: although much work was done, some of these features are still evident today. Also during the period of enclosure certain stream channels had been straightened to form regular curtilage boundaries – in certain cases the Conservators rediverted the water back into the meandering course to restore the picturesque topography (R.C.C.C. 1891). Further restoration work was attempted through filling in many of the old gravel workings. This particular action was criticised by some who saw it as destroying many of the more interesting organisms that had previously been abundant.

As well as restoring the Forest the Conservators also attempted to enhance the appearance of the Forest. A number of ponds were constructed, views and vistas were created or renewed and a certain amount of tree planting was carried out. (For the latter programme, in 1883, the Superintendent purchased 332,779 young trees from the Lawson Seed and Nursery Co., Edinburgh!). Most tree planting was carried out in the early years of the Conservators' management, while towards the end of the century it was restricted to filling in gaps in avenues and covering up unsightly buildings on the edge of the Forest. Some of the old stands are still evident in the Forest including one of sweet chestnut *Castanea sativa* near Strawberry Hill, Loughton and one of larch *Larix decidua* on Piercing Hill, Theydon Bois.

---

*Epping Forest Conservation Centre, High Beach, Loughton, Essex IG10 4AF.

A more extensive planting policy was favoured by some individuals. A. J. Burrows of Kent, after an invited visit to the Forest, suggested the planting of more broad-leaved trees in certain selected sites. He advised 'Popular of every kind – except perhaps, the Lombardy – the wych elm, the common elm, the evergreen oak, Spanish chestnut, willow, wild cherry, maple, sycamore and much more birch might be planted.' He also suggested that 'undergrowths of hazel, elder, rhododendron, mahonia and common bramble might be greatly extended; and, as a tree-guard and most efficient nurse, the Myrobella plum *Prunus myrobalana*' (Burrows 1883). It is interesting to speculate as to what the present structure and composition of the Forest would be if this advice had been taken.

Even more radical however, were the views of the eminent naturalist, Alfred Russel Wallace, who shares with Charles Darwin the credit for originating the concept of evolution through natural selection and who also applied for the post of Superintendent of the Forest. His interest in Epping Forest is further shown through his paper on the management of the Forest where he recommended that the areas recently enclosed and denuded of trees should be planted. He was however, against what he saw as the easiest and simple way through planting 'oaks and beeches with a sprinkling of elm, birch and ash' as he saw this as producing a monotonous woodland. His plan was for a more diversified woodland. To that end he recommended that various parts of the Forest should be planted with trees and shrubs native to various temperate woodland areas of the world.

The first woodland type recommended was Eastern North America which would 'excite interest at every stage of its growth'. Secondly, Western North America including 'the giant Wellingtonia and redwood and the magnificent Douglas fir....planted in masses, groups or belts, and with winding paths, broad glades, and occasional shrub-planted openings admitting of free access to every part of it'. Thirdly, Eastern Europe and Western Asia including 'the nettle-tree, the Judas-tree, the flowering ash, the wild olive, the hop-hornbeam, the almost evergreen Neopolitan alder, and our old favourites the plane, the walnut, the laburnum, and the Portugal laurel' together with 'sweet-scented shrubs of the same district – laurestinas, myrtles, Spanish broom, coronillas, cistuses, Mediterranean heaths, the favourite lilac, and the luscious Philadelphus or syringa'. Fourthly, Eastern Asia and Japan where he emphasised the variety of conifer species stating that there were no less than 46 species belonging to 19 generic groups. Finally, the temperate forests of the Southern hemisphere represented by Chile, Patagonia, Australia and New Zealand. Here amongst a number of species listed he mentioned the pine 'libocedrus, and the well known araucarie, which when grown in avenues or masses produces a very grand effect'. He also listed 'golden-balled buddlea, the lovely flowering evergreens, escallonia and berberis, and the pretty cross-leaved veronica. These would form exquisite flowering thickets to set off the stiff forms of the araucarias'.

Wallace also described how the use of climbing plants could form conspicuous ornament to each area such as adorning the North American Forest 'with festoons of the Virginia creeper and wild vine, while the red trumpet-creeper and the passion-flower of the Southern States would form beautiful objects, climbing over the bushes and among the branches of trees' (Wallace 1878). In the areas that did not require replanting he maintained that 'the presevation of "the natural aspect of the forest", as specially mentioned in the Act of Parliament, should always be kept prominent in view, and this principle should influence the character of such footbridges, dams, banks, or other building or engineering works as may be found to be absolutely necessary' (Wallace 1878).

The following returns from the above ideas which were not put into effect to programmes that were actually implemented. The Conservators placed considerable importance on the provision of access. As a result a number of green rides were constructed through the Forest while in the early 1880s support was given to a plan to extend the railway from Chingford to High Beach. A number of areas were also drained to increase access for the public. It was at this point that visitor management conflicted with habitat conservation. There was concern felt that a proportion of bog and swamp and damp hollows was an essential part of the natural aspect. A balance between recreation and maintaining the natural aspect was called for by concerned naturalists. A member of the Essex Field Club argued that 'It must not be supposed that there is any desire on the part of naturalists to exclude the general public. I wish only to emphasise the fact that up to the present time it would appear that the Forest has fallen into the hands of those who are disposed to regard it exclusively from the point of view of excursionists' (Essex Field Club 1883-4).

The decline and loss of a number of species was attributed to drainage. In one bog an abundance of sundew *Drosera* sp. and a little marsh clubmoss *Lycopodium inundatum* were over a few years reduced to fewer of the former and no trace of the latter (Powell 1892). It was also argued that the reduction of plants would reduce the number of insects using the plants as a food source (Cooke 1882-3). Certain 'ecological' solutions to render the surfaces drier by planting trees such as alder and willow were also suggested (Boulger 1883).

Although considerable work went into the above management a major thrust went into woodland thinning. The need for such a programme was obvious. The fact that the trees were densely packed together when they had been pollarded was of little concern as only a limited canopy was achieved. However, canopy overcrowding as a result of ending pollarding and a subsequent loss of light under the canopy saw a reduction in ground vegetation. The ground was described as being invariably bare of growth of any kind (R.C.C.C. 1889). In looking at the loss of plants in a broader context it may be of interest to note that two other causes were identified. Firstly, picking by visitors (Powell 1892), and secondly a decline of lichens due to acid in the smoke (Crombie 1885-6). Lime trees were also dying from the combined effect of want of shelter and the smoky atmosphere (Wallace 1878). The second would appear an interesting comment in view of our current concern with 'acid rain'.

Some thinning by the Conservators would seem to have achieved the desired effect. The annual report for 1889 recorded an increase in ground vegetation which produced an increase of pasture for the commoners' cattle and also added greater facilities for the enjoyment of the public while the natural aspect of the Forest had been preserved and improved (R.C.C.C. 1888).

In 1889 a set of woodland management guidelines was drawn up providing for an annual light-thinning regime spread over an area of some 500 acres (202.5 ha); little undergrowth was to be removed except where dead or a fire hazard, while pollards were only to be removed after being marked by the Superintendent. A certain amount of external support for this came from Professor Bougler, President of the Essex Field Club, who suggested that some of the old pollards might be removed. However, when the programme was put into action with a number of old pollards being removed from Monk Wood, Loughton, a storm of protest arose from both the press and the general public. *Punch* magazine, in its inimitable fashion, devoted a whole page of satirical verse, with an appropriate illustration, condemning the management, while the *Pall Mall Gazette* wrote that, unless the work ceased, in a few weeks Epping Forest would be a thing of the past.

There was some support however: the Essex Field Club, after a visit to the Forest, commented upon the overall benefits of thinning. An unthinned and a thinned area were compared; in the former area the trees were described as drawn straight up and branchless due to the overcrowding while the herbage was either dying or dead; the latter was described as a beautiful woodland with vigorous lateral branches and a fine undergrowth springing up in all directions (*Essex Naturalist* 1894). The Essex Field Club also made the point, specifically on the debate, that it felt that the thinning had not been as vigorous as suggested by some London Papers (*Essex Naturalist* 1894). This is not to say there were no errors. At one stage a number of trees on Fairmead were marked for felling but the trees actually felled were those that should have been left!

There was also other support. An appointed Committee of Experts also reported in overall favour of the Conservators commenting that the work had been done judiciously and well although it disapproved of the small plantations and suggested a reduction of artificial drainage (First Official Report of the Experts 1894). The opposition was not satisfied however and during the following season, when the thinning programme was renewed, the opposition was revived. To take just two sources; William Morris, the Victorian poet, artist and craftsman, born and bred in Walthamstow, wrote a critical letter to *The Daily Chronicle,* 4 May 1895 (Briggs 1962), while the same paper also published an article condemning the work of the Conservators as "wanton destruction" illustrating the article with drawings (Figs. 1 and 2). This criticism was answered on a number of fronts. In fact William Morris, when he actually visited the Forest, reported with relief that the press criticisms had been exaggerated (Mackail 1911). The Committee of Experts was reconvened and again vindicated the Conservator's management. Indeed, they stated that a lack of thinning would lead to the mutual destruction of the pollards and of the undergrowth (Second Official Report of the Experts 1895). The Epping Forest Committee also produced a favourable report on the management. The bias of the latter appraisal may appear inevitable; however, there is some interesting evidence that may currently be evaluated. This arises from the fact that when visiting the Forest the Conservators took photographs of the sites illustrated by *The Daily Chronicle* (Figs. 3 and 4); through comparing the photograph and illustration from each site it is possible to recognise common features in both. However, it is also obvious that some artistic licence was used. After 1895 the controversy over thinning and the removal of pollards would seem to have subsided with the Conservators receiving no complaints in the following year (R.C.C.C. 1896).

An assessment of the benefits, or otherwise, of landscape change is not always easy. Many aspects have to be taken into consideration including ecology, conservation, economics, safety, aesthetics and time. A management scheme which may be seen as a necessity to some may be construed as vandalism by others. As Professor Mendola (1894) said, during the controversy, 'indeed when the elements of this controversy come to be resolved into their constituents, I think we shall find that differences of opinion will resolve themselves largely into matters of individual taste'. While there are many qualifications to that, there would also appear to be a grain of truth. Today, management programmes such as scrub clearance, are still controversial as is re-pollarding. Regarding the latter it is interesting to reflect that the thinking has changed enough to even consider re-pollarding. Finally social changes have brought new problems to the Forest such as the conflict over horse-riding.

Acknowledgements

I wish to thank the Corporation of London Records Office for kindly allowing permission to use the illustrations, Mr P. A. Moxey for his comments and Freda Staines for the typing.

References

BOULGER, G. S. 1883. Epping Forest and its Future Management. *Forestry* **7**: 90-93.

BRIGGS, A. (Ed.) 1962. *William Morris. Selected Writings and Designs.* Penguin Books, London.

BURROWS, A. J. 1883. Epping Forest and Its Future Management. *Forestry* **7**: 84-90.

COOKE, M. C. 1882-3. The Evils of Deep Drainage from the Naturalist's Point of View. *Trans. Essex Fld Club* **3**, Appendix No. 1: xxi-xxii.

CROMBIE, Rev. J. M. 1885-6. On the Lichen Flora of Epping Forest and the Causes affecting its Recent Diminution. *Trans. Essex Fld Club* **4**: 54-75.

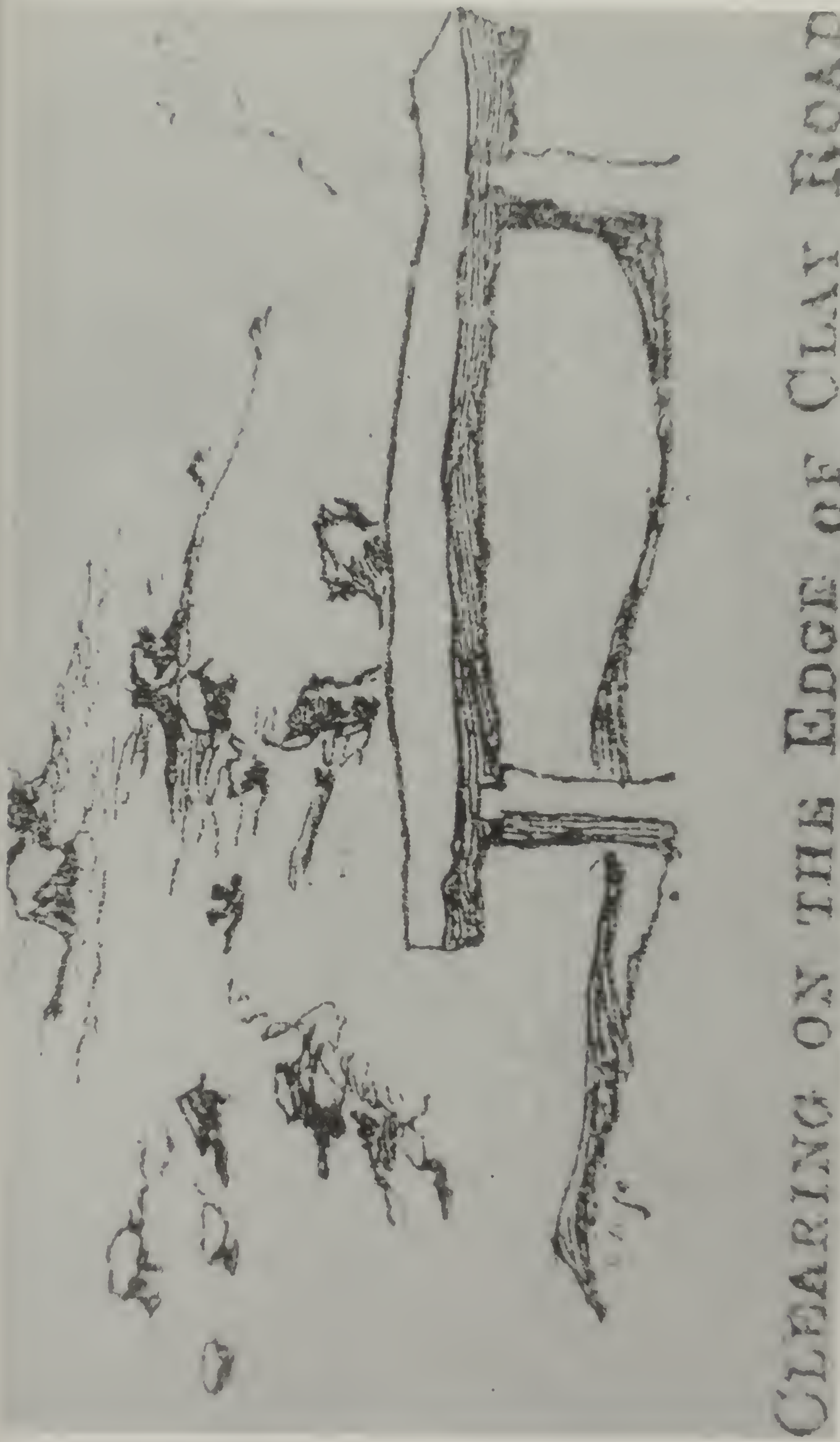

CLEARING ON THE EDGE OF CLAY ROAD

FIG. 1. Edge of Clay Road. Illustration *Daily Chronicle*, 1895.

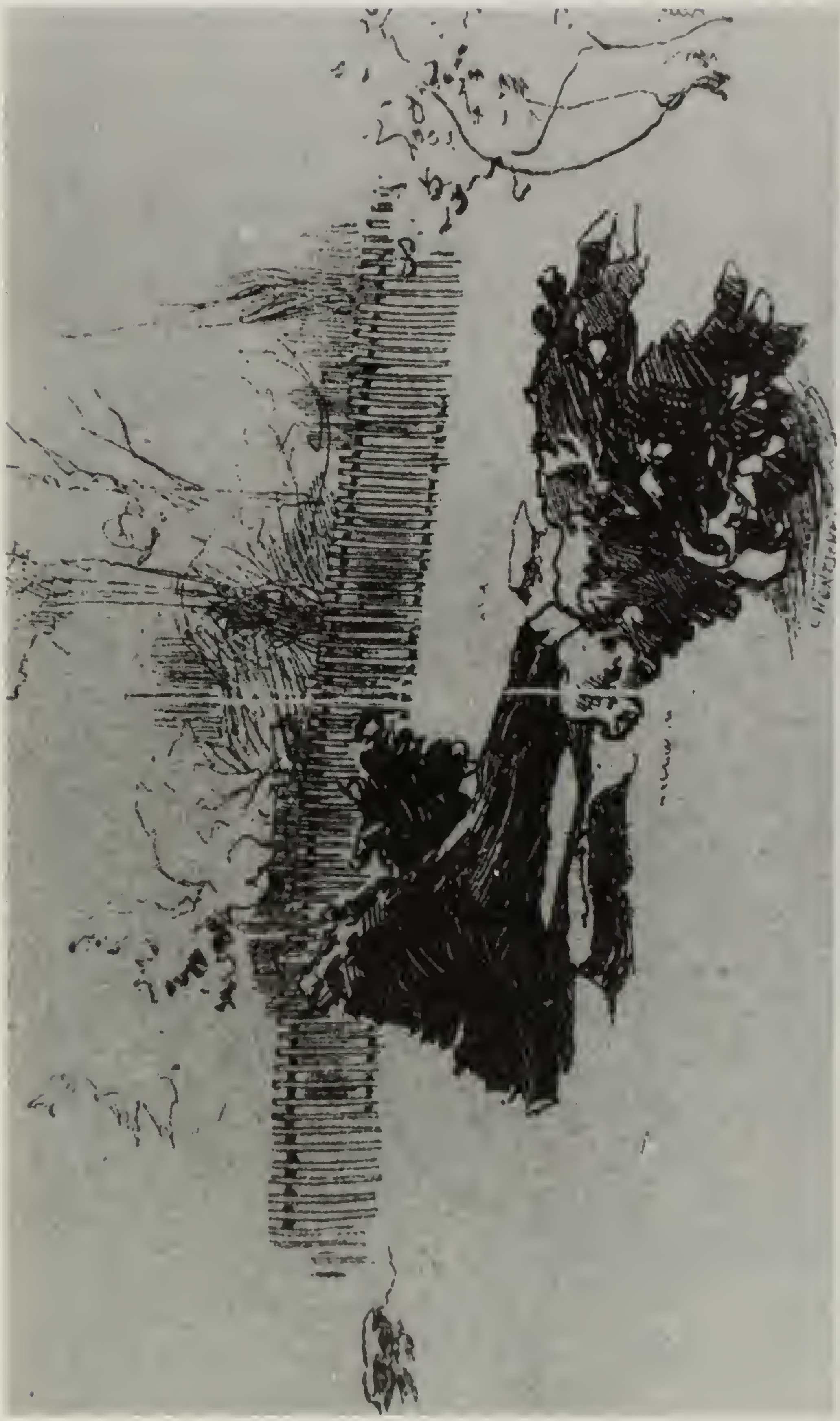


FIG. 2. Woodberrie Hill. Illustration *Daily Chronicle*, 1895.

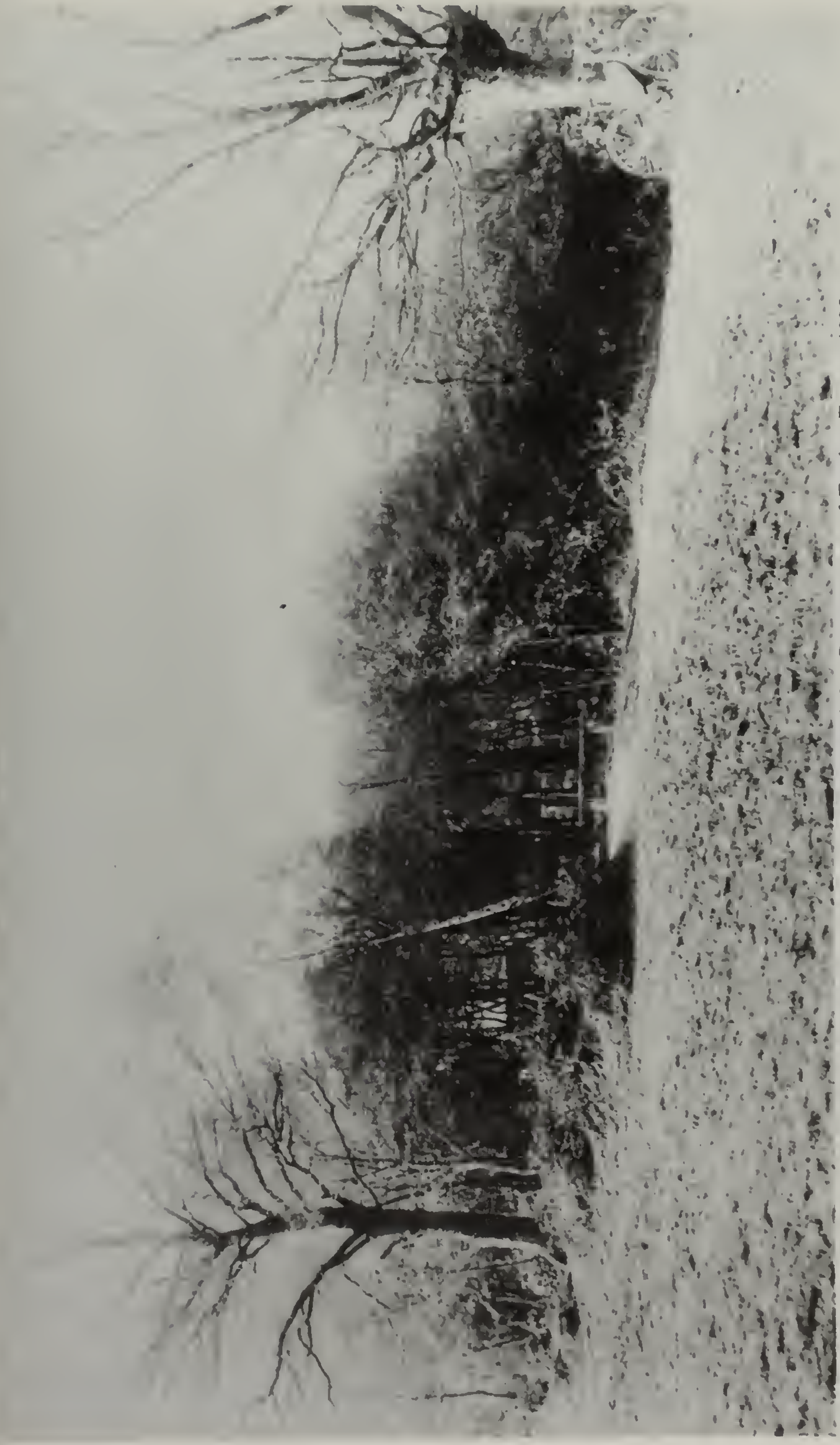


FIG. 3. Edge of Clay Road. Photograph by Conservators of Epping Forest, 1895.

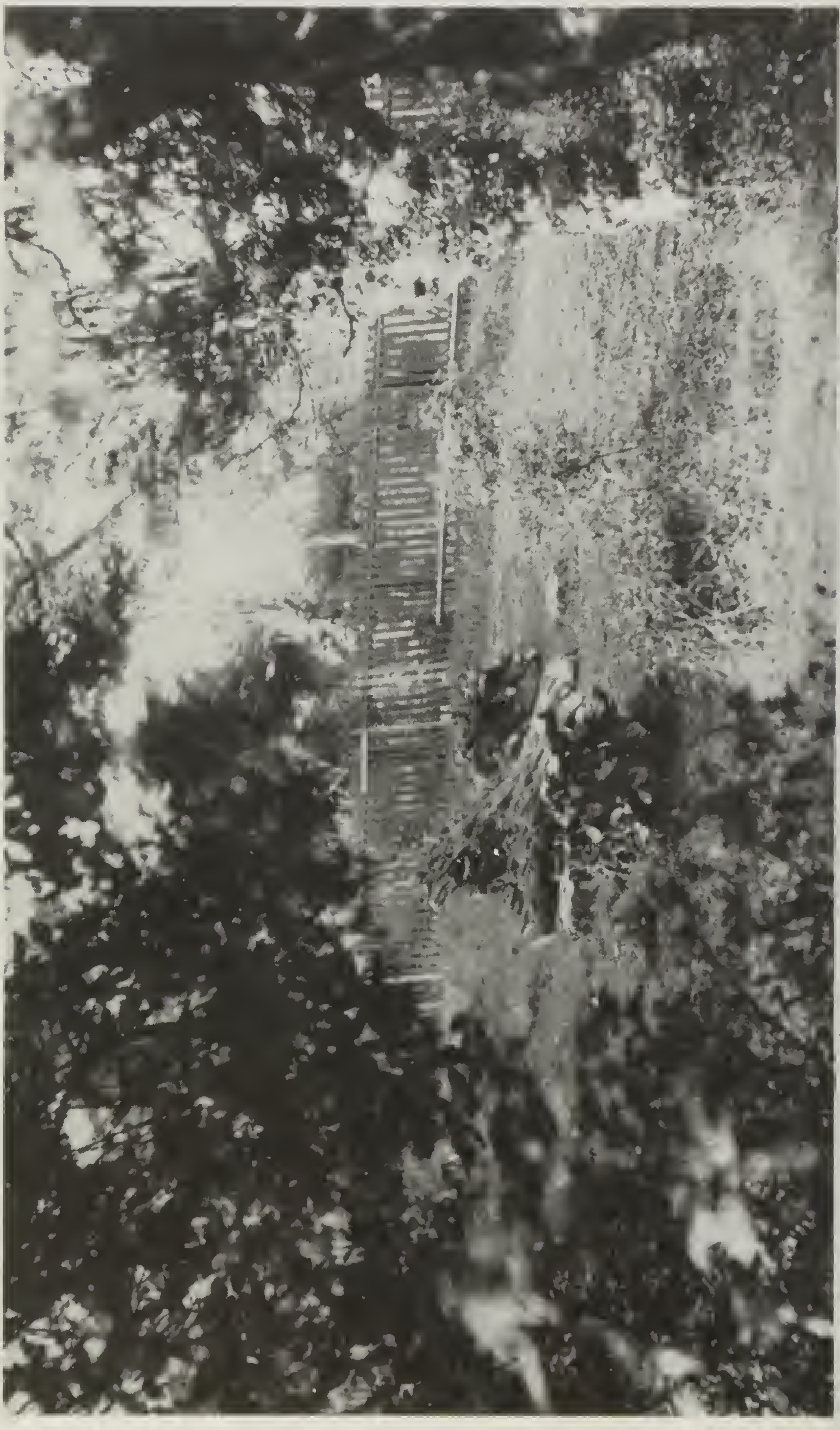


FIG. 4. Woodberrie Hill. Photograph by Conservators of Epping Forest, 1895.

ESSEX FIELD CLUB. 1883-4. Trans. **3**, Appendix No. 1: xxix.

ESSEX NATURALIST. 1894. The Management of Epping Forest. Meeting of Essex Field Club. *Essex Nat.* **8:** 52-71.

EVERSLEY, LORD. 1910. *Commons, Forest and Footpaths.* Cassell, London.

MACKAIL, J. W. 1911. *The Life of William Morris.* Longmans, London.

MENDOLA, R. 1894. The Management of Epping Forest. *Essex Nat.* **8:** 57.

(FIRST) OFFICIAL REPORT OF THE EXPERTS. 1894. The Management of Epping Forest. *Essex Nat.* **8:** 117-121.

(SECOND) OFFICIAL REPORT OF THE EXPERTS. 1896. The Management of Epping Forest. *Essex Nat.* **9:** 74-80.

POWELL, J. T. 1892. The Existing Flowering Plants of Epping Forest. *Essex Nat.* **6:** 1-10.

REPORT TO THE COURT OF COMMON COUNCIL. Guildhall Record Office 1888, 1889, 1891, 1896.

WALLACE, A. R. 1878. Epping Forest. *Fortnightly Review* **24:** 628-645.

Book Review

Mammal Evolution – an Illustrated Guide. By Professor R. J. G. Savage and M. R. Long. British Museum (Natural History), London. 1986. 256 pp. £17.50. ISBN 0 565 00942 7.

This is a very readable history of mammals. Although there is a lot of technical information, mainly for the scientist, there is also much general natural history of great interest to the amateur. The book is very well illustrated with numerous drawings of skeletons, and the shape and arrangement of teeth which, again, is mainly for the expert, but from which the amateur can obtain some idea of the relationship of different mammal groups. However, of special interest to the amateur are the many large illustrations of the mammals, frequently coloured, which give a very clear picture of the animal's probable appearance. There are chapters dealing with how mammals became fossilized, how mammals compare with other animals, how fossil bones are re-clothed with flesh, and how reptiles evolved into the first mammals. Then there are chapters on mammals that eat insects and flesh, those that eat roots and tubers, those that gnaw, the browsers and the grazers, fliers and swimmers, and monkeys and men.

Mammals appeared 220 million years ago, but they kept a very low profile for the next 150 million years while dinosaurs reigned supreme. When the latter disappeared, however, mammals began to replace them and to spread over the land, seas and even the sky. The book emphasises what habits can be deduced from the bones and structure of the teeth. There is only one group of osteological features on which we can rely for separation of reptiles from mammals. In all mammals the skull and mandible articulate using the squamosal and dentary bones, and there are three middle ear bones – the stapes, incus and malleus. The bones of a very large number of extinct genera and species have been found.

A few of the interesting facts might be mentioned. The rodents (hamsters, mice, rats and voles) were an immensely successful and diverse group, but which only became ubiquitous within the past 5 million years. The plague bacillus, living in the gut of the parasitic flea on the black rat *Rattus rattus,* is thought to have killed 25 million people by plague in the Middle Ages. The rhinoceros *Indricotherium* is the largest land mammal that ever lived; it stood 5.4 metres at the shoulder, and, with its long neck and 1.3 metre-long skull, it could browse on vegetation over 8 metres above the ground. With a probable weight of 30 tonnes it was 4½ times as heavy as an elephant (6.6 tonnes) and nearly twice the estimated weight of a mammoth. The most celebrated fossil deer *Megaloceros* (giant Irish elk but essentially a giant fallow deer) ranged from Ireland to Siberia and China – 80 skeletons have been found in a bog near Dublin. The palmate antlers could span 3.7 metres and weigh 45kg. In western Asia 9,000 years ago goats and sheep were being domesticated, to be followed by cattle, pigs, horses and camels. Their importance in the economy of man (together with crop cultivation and medicine) is perhaps most clearly reflected in the dramatic rise in human populations from 100 million people 10,000 years ago to 4,500 million today.

This book is full of valuable information. There is also a useful glossary and a list of books and references for further reading.

GEOFFREY BEVEN

Book Reviews

F. W. Frohawk: His Life and Work. By June Chatfield. The Crowood Press, Marlborough. 1987. 184 pp. £16.95. ISBN 0 946284 68 7.

I think we can all look back on our early days as naturalists and bring to mind the events that started us on our lifelong avocation and decided for us which branch of natural history we were going to follow. We would probably go to the library and see what books there were, or we might have been lent a book or two by a friend or relative. My interest in butterflies was kindled by the knowledge that my paternal uncle from Forty Hill, Enfield was a keen naturalist and that he and my father had been two of the 'boys' of E. A. ('Gussie') Bowles of Myddelton House. Then I learnt that my next-door neighbours' grown-up son had a collection of Lepidoptera. My local library had *The Complete Book of British Butterflies* by F. W. Frohawk (1934) and one of Kirby's butterfly and moth books: these I renewed time after time. I later learnt that Frohawk had died the year that I started seriously collecting butterflies and moths (and I learnt later still that Richard South had died the year I was born). I was fascinated by the fact that Frohawk had reared all the British species of butterflies from adult through to adult, a task which took him 24 years, and had used these specimens to illustrate the complete life-cycles for his earlier two-volume *Natural History of British Butterflies* (1924). The juvenile stages alone necessitated at least 900 drawings. Over the years other authors' works were added as one's interests widened and as other books appeared, but always at the back of the mind was 'Frohawk' and his life-histories of butterflies. One of his greatest achievements had been that of solving the mystery of the life-cycle of the large blue butterfly – alas no longer a British species.

In March this year an exhibition on the life and work of F. W. Frohawk, assembled by June Chatfield, Curator of the Gilbert White Museum at Selborne, appeared in the Natural History Museum. I received an invitation to attend the launch in the Museum on 2 June of Dr Chatfield's book. And what a superb book it is. Frohawk was a man of many parts and although he will be remembered primarily for his classic two-volume *Natural History of British Butterflies* he painted many other animals, especially birds, as well as mammals and fishes and plants – not only foodplants! The book contains 120 illustrations of which 33 are in colour and are interspersed throughout the text. They are delightful and I can strongly endorse the publishers' sentiments by repeating 'Whether for its scientific natural history content, its contemporary descriptions of the British countryside or its fine examples of Frohawk's art, this book holds hours of enjoyment for every reader.' I thoroughly enjoyed reading it. At the reception just referred to, we were privileged to meet Frohawk's daughter Valezina, who figures prominently in the book and after whom her father named a form of the silver-washed fritillary butterfly. Afterwards there was a public lecture by Dr Chatfield on Frohawk's life and work.

The chapters contain many excerpts from Frohawk's recollections and these add flavour to the text. The text itself is well researched and it follows Frohawk's development as a naturalist, artist and writer from his childhood in Essex, his move to Croydon and a career '...Croydon was then an old fashioned country town, with a population of some 70,000...', his association with other eminent naturalists of the day, the descriptions of the British natural history scene from the late nineteenth century to the mid twentieth century, the red squirrels on Tooting Common and many, many episodes for the reader to dwell on. There is no better way of gaining an insight into past times than by reading a biography of someone to whom one can relate a common interest and this volume I strongly commend to London's naturalists. June Chatfield has done us and F. W. Frohawk a great service.

K. H. Hyatt

The Secret World of Bats. By John and Molly Hines. Methuen Children's Books Ltd, London. 1986. 64 pp. £4.95, ISBN 0 416 49040 9.

This is a book which cannot be put down once opened. It will not only educate children, but all in the understanding of bats, their life-style and true nature. It deals with their breeding behaviour and the fascinating facets of their echo-location systems. Hibernation is discussed in detail and most important of all if the general public are to be converted, the folklore, myth and legend concerning bats are exploded. There are many black-and-white photographs, and the purchase of this book can be fully recommended.

R. V. Goulding

The Field Layer of Perivale Wood

by Nic Ferriday*

Synopsis

Perivale Wood is a small woodland in west London consisting of mature oaks with an understory of hazel and hawthorn. The field layer is dominated by bluebells and brambles with negligible amounts of other species. The distribution of both bluebells and brambles is very patchy but this can be explained by considering the behaviour of the species and certain factors which affect their abundance. Bramble abundance is determined largely by light level which varies from one point to another while bluebells show a strong relationship with the depth and compressibility of the topsoil. There is no evidence of association, positive or negative, on a small scale and no evidence that the bluebells and brambles compete. This is probably because they are affected by different factors and because their behaviour is so different that they occupy different niches.

Introduction

This article describes a study of the field layer of Perivale Wood in which the abundance of the dominant species was investigated and an attempt made to relate their abundance to the surrounding trees and shrubs and to a number of environmental factors. The work was carried out for the 'Diploma in Ecology and Conservation' run by the Extra-Mural department of the University of London.

Perivale Wood

Perivale Wood is one of the oldest nature reserves in the country. It lies some 14 km W.N.W. of central London in the Borough of Ealing (tetrads 18T42 and 18T46). It is a Local Nature Reserve as well as an S.S.S.I. and is owned by the Selborne Society. The reserve lies in the Brent Valley between 23 and 29 metres above sea level. The area is underlain by London Clay but the topsoil within the wood is a well-drained mull humus. The core of the reserve is oak woodland around which there are a number of other habitats including a strip of elm woodland, hedgerows, an old rubbish dump, pasture and ponds. A description of the reserve has been published in this journal (Roberts and Edwards 1974).

Perivale Wood is thought to have been a woodland ever since forests grew up after the last Ice Age, although there is documentary evidence that around 1810 most of the large trees were felled. Since then it has been managed as coppice-with-standards, but coppicing largely ceased after the second world war. The wood was subject to considerable disturbance until the early years of this century and as a result, primroses were exterminated and bluebells decimated. Following its acquisition as a nature reserve and subsequent control of access during the last 70 years, the field layer has been allowed to develop undisturbed.

Although there has been a long history of recording wildlife, relatively little systematic recording of the flora has been done. The only major survey was done in 1973 and published in this journal (Roberts and Edwards 1974). The wood consists of mature oak standards *Quercus robur,* apparently of rather uniform age, with a shrub layer of hazel *Corylus avellana* and hawthorn *Crataegus monogyna* and *oxyacanthoides.* There is a scattering of other trees and shrubs including elder *Sambucus nigra,* mountain ash *Sorbus aucuparia,* field maple *Acer campestre,* ash *Fraxinus excelsior,* crab apple *Malus sylvestris,* holly *Ilex aquifolium* and blackthorn *Prunus spinosa.* The field layer is dominated by bluebell *Hyacinthoides non-scripta* and bramble *Rubus fruticosus* agg. The bluebells are a magnificent sight in spring and Perivale Wood is regarded as one of the finest bluebell woods in the London area.

*6 Boston Gardens, London W7 2AN.

Methods

Sampling Schemes

Because variations over a wide range of scales were being investigated, no single sampling scheme would suffice. A number of methods were therefore used in combination:

i. A grid of sample points at which quadrats were placed for assessing the abundance of field layer species and around which various measurements of the trees and shrubs and environmental factors were made.
ii. Transects along which quadrats were placed and the position of the stems and canopies of the trees and shrubs sketched.
iii. Sample plots in which the position of tree and shrub stems and canopies were sketched together with areas of different subjectively-assessed abundance of field layer species.

Measuring Field Layer Species

The primary measure of abundance was percentage cover. Quadrats were divided into 25cm × 25cm sub-quadrats and the percentage cover in each estimated by eye. At a proportion of sample points, the cover was estimated both in spring and summer. In addition to cover, bluebell abundance was assessed by plotting positions of individuals within 1m × 1m quadrats and thereby counting the plants. This was done in early spring when the plants were small and therefore easier to seperate. Figure 1 shows an example of such a plotting. In early summer the number of flowering plants were counted in the same quadrats. In addition to cover, bramble abundance was assessed by recording the diameter of the thickest stem in each 25cm × 25cm sub-quadrat. Both bluebell and bramble abundance were also assessed by eye over larger areas than quadrats using a 6-point scale ranging from ‘very dense’ to ‘none’.

Measuring Trees and Shrubs

Trees and shrubs, being the dominant organisms in the wood, are likely to have a major effect on the field layer so measurements of them were made. In the sample plots, along transects and within 5m of sample points, the position of each stem was noted together with the species and the girth of the stem(s). An assessment was also made by sketching the approximate shape of the canopy of each tree and shrub as projected onto the ground.

Measuring Environmental Variables

Because they were generally more time-consuming to measure, environmental factors were only measured at a selection of sample points. The factors assessed were:

Topography. The direction and extent of any slope was assessed subjectively, e.g. ‘slight slope down to SE’.

Spring light level. This was measured before the leaves of the canopy emerged, using a Gossen ‘Profisix’ photographic light meter. The meter was set to accept light from a complete hemisphere. Measurements were taken in overcast conditions because on bright days variations due to sunflecks and shadows cause instantaneous measurements to be meaningless. Results were related to the equivalent light level in an unshaded position, the latter being measured using the meter outside the wood as close in time as possible to the measurement inside. In this way the light level at a point in the wood can be expressed simply as a percentage of the light in the open.

Summer light level. This was measured in exactly the same way, but after the canopy leaves had emerged.

Open sky in spring. Photographs were taken vertically upwards using a fish-eye lens which gives a picture of a complete hemisphere. The percentage of sky not

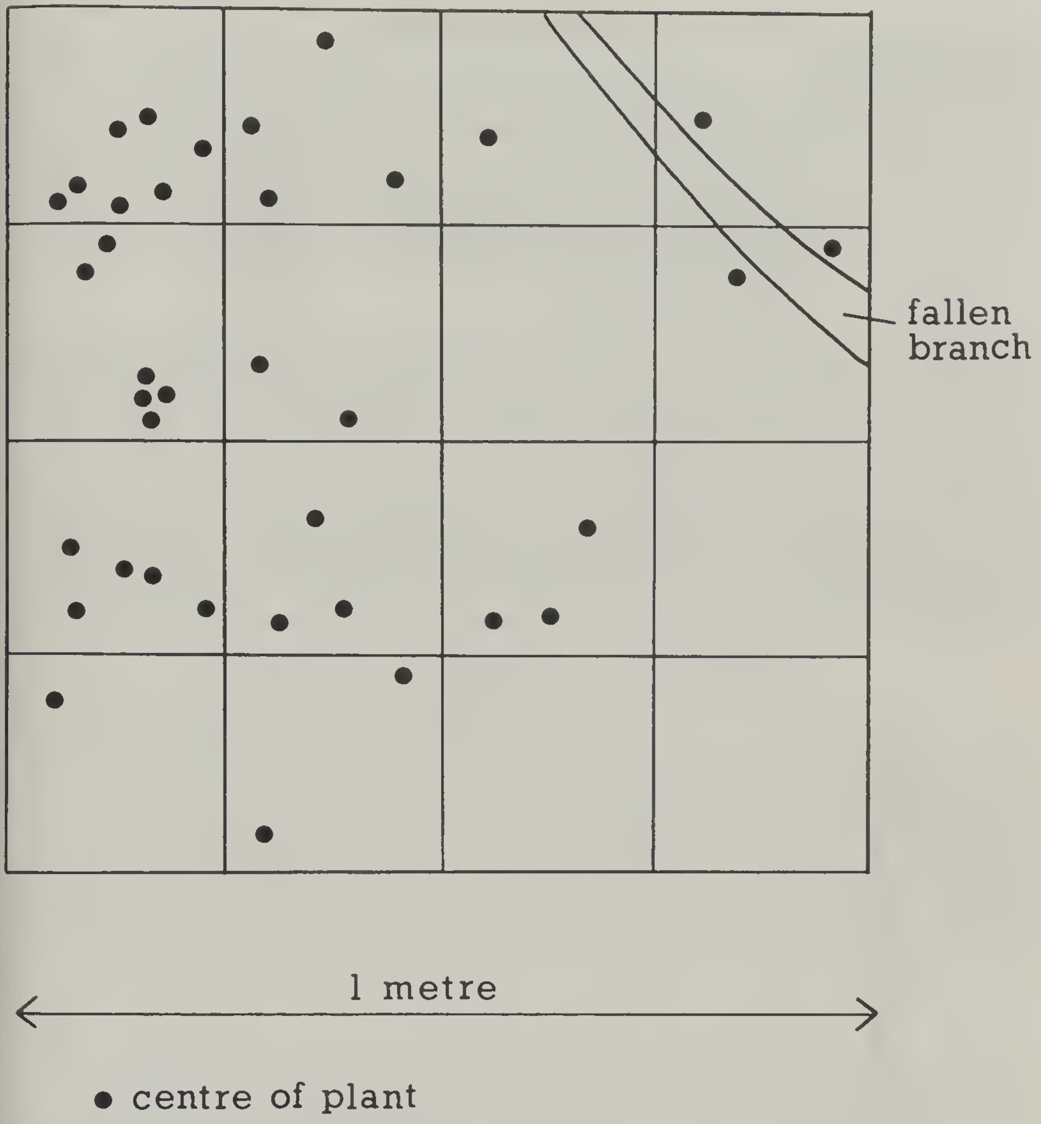


Fig. 1. Example of plotting of positions of bluebells.

obscured by branches and stems of the canopy could then be estimated from the photos.

Open sky in summer. This was measured in exactly the same way, but after the canopy leaves had emerged.

Topsoil depth. There is a distinct layer of leaf litter and loose soil above the solid clay. The depth of it was measured by making small excavations.

Topsoil compressibility. This was assessed by measuring the depression in the soil surface caused by application of a standard weight.

Soil pH (pH papers). 'Johnson' pH papers were used to test samples of the topsoil and the top of the clay layer.

Soil pH (meter). In situ measurements of the topsoil and clay were attempted using a 'Demetra' combined pH and moisture meter.

Soil moisture. Measurements were attempted using the same meter and same procedures. The meter records moisture as a percentage of the saturation level of the soil.

Analysis and Results

Ground Cover

From quadrat data the ground cover is:

Bramble *Rubus fruticosus* agg.	30%
Bluebell *Hyacinthoides non-scripta*	27%
Dead wood	0.43%
Tree stumps and stems	0.33%
Honeysuckle *Lonicera periclymenum*	0.033%
Wood millet grass *Milium effusum*	0.009%
Unidentified seedlings	0.009%
Goosegrass *Galium aparine*	0.002%

There are also a number of other species not found in the quadrats, mostly occurring in clearings or by the side of paths. Non-vascular plants were not recorded but are very scarce, not growing on the unstable leaf litter.

Bluebells

The average cover of bluebells in the wood is about 27% at the time of their greatest extent – in early summer. However this conceals great variations, for as shown in Figure 2, the cover in a small area varies from 0 to 100%. From the counts of bluebells in quadrats, the population across the whole wood can be estimated:

Total plants	5.2 million	± 1.9 million
Flowering plants	3.9 million	± 1.3 million

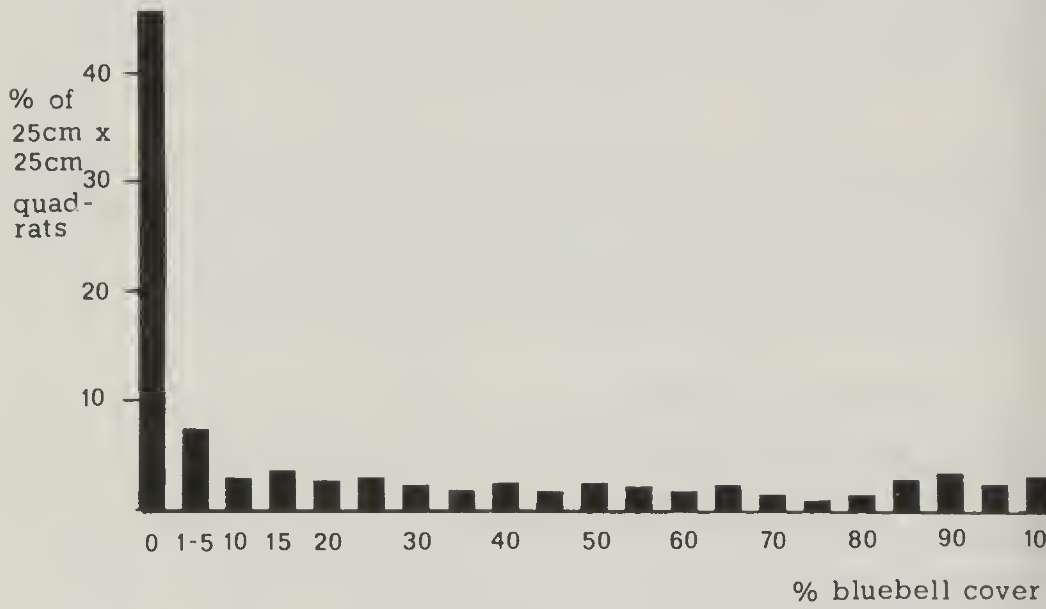


Fig. 2. Variation of bluebell cover.

This indicates that about three-quarters of the plants flower in a year. The bulbs of bluebells get bigger each year and only when the bulb has reached a certain size does the plant flower (Blackman and Rutter 1954). If they flower first in their fifth year (Blackman and Rutter 1954) and flower each year thereafter, the average life can be calculated as 16 years. (Certain other assumptions are needed to make this estimate and the average life excludes any plants which do not survive long enough to show above ground).

The patchiness of cover was investigated statistically by analysing the variance of cover values and numbers of plants in successively larger blocks (see Kershaw 1973 for the type of method employed). The analysis showed no evidence of a characteristic size of patch or clump; instead there is patchiness present at every scale investigated – from 2cm to 120m. The various measures of abundance at a sample point; namely cover in spring, cover in summer, number of plants and number of flowering plants, are of course numerically quite different but as might be expected, the measures correlate strongly. Thus, a quadrat with more plants than another will also have more flowering plants, higher cover in spring and higher cover in summer. These correlations mean that which measure of abundance is selected does not greatly affect the results of analyses where bluebell abundance is related to other quantities.

Brambles

No attempt was made to identity the various microspecies of bramble *Rubus fruticosus* agg. The average cover is about 30% at the time of their greatest extent – in late summer. As with bluebells the cover is extremely variable, with values from 0 to 95% and histograms of cover are in fact similar to those of bluebells. Patchiness was analysed statistically in a similar manner as for bluebells and again, no characteristic size of patch or clump was indicated. Instead there is patchiness at all scales investigated – from 25cm to 120m. As with bluebells, the various measures of abundance are strongly correlated so which one is selected does not greatly affect analyses where bramble abundance is related to other quantities.

Association of Bluebells and Brambles

Having investigated the abundance of bluebells and brambles separately, an obvious question is whether the two species are associated, either positively or negatively. That is, do they tend to grow together or do they tend to avoid each other? Statistical analysis of the combinations of bluebell and bramble abundance was carried out by calculating correlation coefficients and by using contingency analysis. Despite large samples (over 600 25 × 25cm sub-quadrats) no evidence of association could be found, so it appears that the abundance of the species at a point are completely independent.

Trees and Shrubs

A set of records of trees and shrubs showing the species, position of stem and the girth are not in a form convenient for statistical analysis such as finding correlations with other factors. Therefore the set of records at each sample point was converted into two simple quantities: a 'tree/shrub proximity' factor and a 'tree/shrub species' factor. The tree/shrub proximity factor was calculated as:

$$\sum (\text{girth} \div \text{distance from sample point})$$

where the summation is over all trees within 5m of the sample point.

This gives a measure of how numerous, close and large the trees are. By examining the species contributing to this proximity factor, the point may also be classified according to the main species e.g. 'oak' or 'hazel + hawthorn', thereby giving the tree/shrub species factor.

The sketches showing the position of the canopy of trees and shrubs are also not in a form convenient for statistical analysis. A simple measure was devised by classifying a point according to whether it is under canopy or not and roughly how far from the edge of the canopy. For instance, a sample point might be classed as '2-3m inside' (that is under the canopy and 2-3m from the vertical projection of the canopy edge on the ground) or '0-1m outside' (that is not under the canopy and 0-1m away from the edge of it). Since the tree and shrub layers are distinct, two separate factors could be identified in this way – 'tree canopy' and 'shrub canopy'.

Environmental Factors

Topography. Although the overall slope of the wood is gently down to the S.E., there are undulations and as a result, only a quarter of the sample points actually have this slope. The other sample points are flat or slope in different directions but there is no pattern across the wood.

Spring and summer light levels. It was not possible to obtain accurate estimates of light levels from light meter readings due to rapid changes in light, even in overcast conditions. The range of values at sample points, expressed as a percentage of the light in the open was:

	Lowest	Highest	Average
Spring	11%	67%	39%
Summer	1%	21%	7%

This shows clearly the effect of the leaf canopy in reducing light.

Although the percentage light level at a particular point was always lower in summer than in spring, there was no statistical correlation between the spring and summer values. That is, a point which is brighter than another in spring is not necessarily brighter than it in summer.

Open sky. The percentage values of open sky at sample points, obtained from canopy photos were:

	Lowest	Highest	Average
Spring	27%	64%	51%
Summer	3%	34%	17%

The percentage of open sky at a particular sample point was of course always lower in summer than in spring, but again there was no correlation between spring and summer values. The percentage of open sky can be converted to an estimate of light as a percentage of that in the open (Anderson 1964, Evans and Coombe 1958). As a first approximation the percentage of open sky is equal to the percentage of light (leaves considered opaque) but more precise calculations allow for the fact that the sky is not equally bright in all directions. The net effect is generally to convert the percentage of open sky figures to slightly higher percentage light figures; spring and summer averages of 51% and 17% being respectively increased to 57% and 18%. (The increase is due to the fact that breaks in the canopy most commonly appear at high angles where the sky is usually brighter). The light levels obtained in this way from canopy photos ought to correspond to those obtained from meter readings. In fact the results from the light meter were much lower than those from canopy photos as illustrated by the averages:

	Light meter	Canopy photos
Spring	39%	57%
Summer	7%	18%

The reason for this discrepancy is unclear; factors such as the spectral response of the light meter, transmission of light through leaves and uncertainties in the conversion of percentage open sky to percentage light level do not explain the differences. Although there are such large differences in these two estimates of light levels, there is a strong statistical correlation between them. That is, a sample point brighter than another according to light meter readings is also brighter according to canopy photos. So while the actual percentage values must be very suspect, the relative differences between sample points should be meaningful.

Topsoil depth and compressibility. The depth of topsoil ranged from 4cm to 20cm and the range of compressibility was about fourfold. The two factors are however strongly correlated.

Soil pH and moisture. It was found impossible to obtain consistent estimates of pH on a sample using the pH papers. Estimates of soil pH and moisture taken in situ by the meter were also hopelessly inconsistent. It would thus appear that the quick methods attempted in this study are not worthwhile and that there is no substitute for careful collection of samples with tests carried out in a laboratory using reliable methods. Although no results were obtained for pH and moisture, there is in fact no reason to expect significantly differing values. No differences in soil texture or appearance were observed and in a previous detailed study (Bartlett 1962), no variations in pH were noted.

Relationship Between Tree/Shrub Factors and Environmental Factors
While some pairs of factors showed no relationship, a number of combinations of tree/shrub and environmental factors did show a relationship:

tree/shrub spp. v. spring light level (light meter)	Points with hazel tend to be brighter than those with other species.
tree/shrub spp. v. open sky in spring (canopy photos)	
tree/shrub spp. v. summer light level (light meter)	Points with hawthorn tend to be brighter than those with other species.
tree/shrub spp. v. open sky in summer (canopy photos)	
tree canopy v. summer light level	Points away from canopy are brighter

In each case statistical analysis suggested that the relationship was real but did not prove it reliably at the 95% confidence level.

Effect of Tree/Shrub Factors and Environmental Factors on the Field Layer
The abundance of bluebells and brambles were analysed against each factor separately, by inspection and statistically. (No attempt was made to deduce relationships with several factors simultaneously by means of multivariate analysis as this was not warranted by the quantity and accuracy of data). A summary is given in the table below followed by a brief description of the relationships:

Factor	Statistical method	Relationship with bluebells	Relationship with brambles
Tree/shrub proximity	correlation	none	none
Tree/shrub spp.	Analysis of variance (Anovar)	probable	probable
Tree canopy	Anovar	none	strong
Shrub canopy	Anover	none	strong
Topography	Anovar	none	none
Spring light level	correlation	none	strong
Summer light level	correlation	none	strong
Open sky in spring	correlation	none	strong
Open sky in summer	correlation	none	strong
Topsoil depth	correlation	strong	none
Topsoil compressibility	correlation	strong	none

Although it could not be demonstrated convincingly by statistical tests, there is evidence that the abundance of bluebells and brambles are affected by the tree/shrub species. In the case of bluebells there appears to be a preference order: hazel – hawthorn – oak; that is bluebells tend to be more abundant near hazels. Brambles on the other hand, appear to be less abundant near hazels than they are

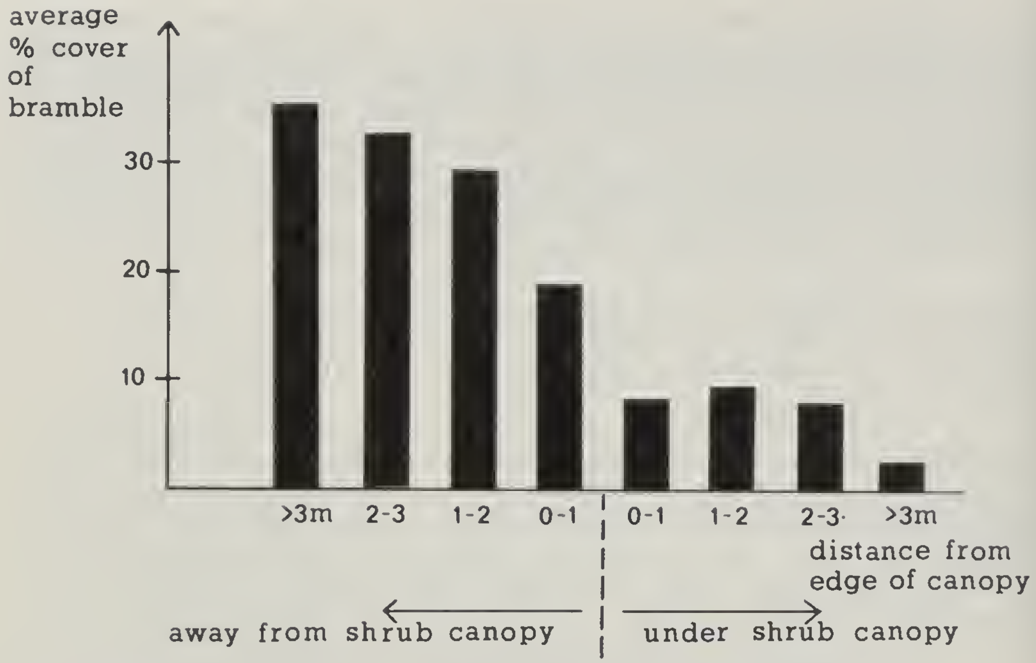


FIG. 3. Variation of bramble cover with position relative to shrub canopy.

near hawthorn or oak. A second set of relationships is that of bramble abundance with tree and shrub cover. Figure 3 shows how the abundance declines as one moves under the shrub canopy. Tree canopy has the same effect. The third set of relationships are between the light level or open sky factors and bramble abundance. Brambles are more abundant at higher light levels or higher percentage open sky. Since, as described previously, the light level is correlated with open sky, it is not surprising that brambles should correlate with both rather than only one. What is less predictable however, is that bramble should correlate with both spring and summer light or open sky, since spring and summer values are themselves not correlated. An illustration of the relationship is shown in Figure 4 where it can be seen that at low light levels there are no brambles and at

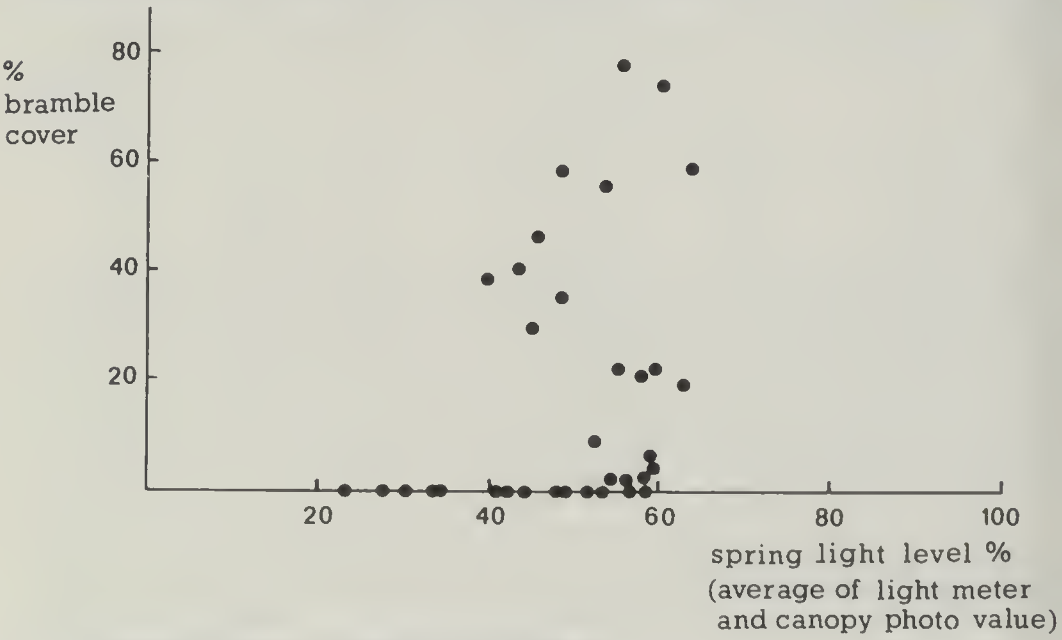


FIG. 4. Bramble cover as a function of light level.

higher levels there may or may not be. Thus the light level appears to be a limiting factor rather than a determining one. The final set of relationships are between bluebell abundance and topsoil depth or compressibility. As the two factors are themselves correlated, it is again unsurprising that bluebells should be correlated with both rather than only one. Figure 5 shows the nature of the relationship and it can be seen that although there is a wide scatter, bluebells tend to be more abundant where the topsoil is deeper.

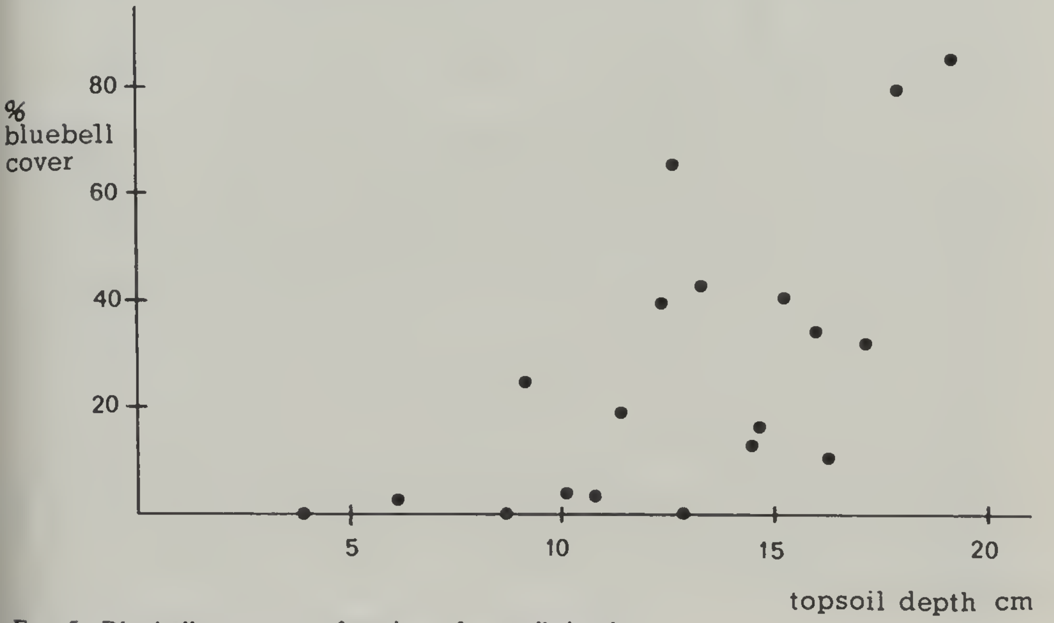


FIG. 5. Bluebell cover as a function of topsoil depth.

Discussion

The most notable feature of the field layer is the complete dominance of bluebells and brambles and the insignificant amount of other species. Even where other species do occur, it is usually in some slightly different habitat such as the edge of a path or in an old clearing. More species are found along the woodland edge which is effectively a range of habitats from close canopy woodland to open. This all supports the view that species diversity in an area is a function of the number of habitats rather than the size of the area or its stability.

The abundance and patchiness of bluebells are clear enough but reasons are less so. Explanations may invoke external factors or features of the bluebells themselves. Clumping on a small scale, say from a few cm to a few m, can be readily explained in terms of the mode of reproduction. Bluebells sometimes reproduce by bulb splitting and this will obviously tend to produce clumping. More often they reproduce by seed and the seeds, being round and not too light, do not travel far from the parent plant (Knight 1964). This too will tend to cause clumps. The only external factors found in this study to be clearly significant are the topsoil depth and compressibility. These two factors are strongly correlated, no doubt because a thick topsoil will naturally tend to be more compressible and they are therefore best regarded as a single factor. Bluebell seeds require an environment that is neither too wet or too dry in order to germinate and grow. Furthermore, the bulbs need to be able to move in the soil, being drawn down by the contractile roots (Blackman and Rutter 1954). A deep, spongy topsoil will enable seeds to roll into crevices where they are protected from damage and desiccation, will allow water to drain freely thereby preventing waterlogging and will allow bulbs space to grow and move. This is probably why the abundance is correlated with the topsoil depth and compressibility.. The existence of such a layer, not compressed by trampling in Perivale Wood, may explain why bluebells are so common, even though they are generally recognised as being most common on light, often sandy, soils rather than on heavy clay. There is another facet to this. Bluebell leaves rot down rapidly in summer to form a deep spongy layer. It therefore appears that bluebells actually encourage conditions suitable for their perpetuation; a thing which many other species do not achieve. This furnishes a further explanation of why bluebells are patchy and persistant – once they have colonised a place they will tend to remain because they improve their own environment. The final reason why bluebells are abundant is that they are not trampled. Apart from any effect of compressing topsoil, bluebells are very susceptible to trampling (Blackman and Rutter 1950) so the minimal trampling in Perivale Wood is a crucial factor.

The apparent lack of a relationship between bluebell abundance and light levels and with other factors related to light such as open sky and canopy is surprising. Blackman and Rutter (1946) reported that abundance was strongly affected by light as a result of studies in three woods. The reason why no relationship was found here may be that most of the sample points in this oak woodland have sufficient light in the bluebells' growing season. As long as there is sufficient light to allow them to grow properly, there is no obvious reason why extra light should increase abundance. Although light has been discussed as if it were a simple factor which can be represented just as a percentage of light in the open, it is in reality very complicated. For instance, a gap in the canopy positioned so as to allow sunlight to reach the field layer in April will greatly increase the photosynthetic potential of bluebells. Also, because the main growing period is only a few weeks around the time that the canopy leaves emerge, a difference in the time of leaf emergence could be critical. It is suggestive that bluebells are more abundant near hazel than near hawthorn and that the hazel leaves emerge a couple of weeks later (even though no direct relationship between abundance and light levels was found).

The abundance and patchiness of brambles may also be considered in terms of external factors and features of the plant itself. Brambles reproduce mainly vegetatively, forming bushes and clumps and this can explain patchiness at a scale of up to several metres. Correlations of abundance found with various factors can all be related to the effect of light. The open sky in spring, open sky in summer, tree canopy and shrub canopy, are probably all manifestations of light levels as of course are the more direct estimates from light meter readings. This confirms the common observation that brambles are more abundant in brighter parts of woods and absent in dark parts. The fact that light levels limit but do not control bramble abundance is also readily explained. Because they spread vegetatively, it is quite possible that there are bright places which would allow bramble to flourish, but where there is none, simply because the place is not contiguous to a site where bramble happens to be and from which it can spread. This, together with the variations of light levels across the wood, satisfactorily explains the patchiness at a larger scale. The fact that there is a reasonable amount of light over much of the wood explains the abundance overall. Thus the effect of light and features of the brambles themselves adequately explain the distribution in Perivale Wood without recourse to any other factors.

The dependence or otherwise of bluebell and bramble on certain factors helps to explain why the species are distributed independently of each other. Because bluebells are affected by topsoil factors but not much by light and brambles are the reverse, this will not lead to an association. Brambles are aggressive plants, able to grow much faster and overtop bluebells so they might be expected to oust them. However bluebells are tolerant plants, not requiring high light levels or high levels of nutrients (Blackman and Rutter 1950) so they can survive well in the presence of brambles. The fact that the main growing season of the plants differs probably also minimises competition; the two species of the field layer may be regarded as having a 'temporal niche' rather than a 'spatial niche'.

References

ANDERSON, M. C. 1964. Studies of the woodland light climate. *J. Ecol.* **52:** 27-41.

BARTLETT, T. L. 1962. *Bird Sanctuary.* Selborne Society.

BLACKMAN, G. E. and RUTTER, A. J. 1946. The light factor and the distribution of the bluebell in woodland communities. *Ann. Botany* (N.S.) **40:** 361-390.

BLACKMAN, G. E. and RUTTER, A. J. 1950. An assessment of the factors controlling the distribution of the bluebell in different communities. *Ann. Botany* (N.S.) **56:** 487-520.

BLACKMAN, G. E. and RUTTER, A. J. 1954. *Endymion nonscriptus. J. Ecol.* **42:** 629-638.

EVANS, G. C. and COOMBE, D. E. 1958. Hemispherical and woodland canopy photography and the light climate. *J. Ecol.* **47:** 103-113.

KERSHAW, K. A. 1973. *Quantitative and dynamic plant ecology:* 128-144. Ed. 2. Arnold, London.

KNIGHT, G. H. 1964. Some factors affecting the distribution of *Endymion nonscriptus* in Warwickshire woods. *J. Ecol.* **52:** 405-421.

ROBERTS, K. A. and EDWARDS, P. J. 1974. The flora of Perivale Wood nature reserve. *Lond. Nat.* **53:** 34-51.

Book Review

Thames-side Guidelines: an Environmental Design Handbook for London's River. Department of Transportation and Development, Greater London Council. 1986. Not priced. 127 pp. ISBN none.

In its proposed alterations to the Greater London Development Plan, submitted to the Secretary of State in 1984, the G.L.C. undertook to 'carry out a Thames-side study, in consultation with borough councils, to develop the policy framework for environmental design along the riverside... Detailed guidelines will be considered in the....study and should be used when considering development proposals...'. With some differences which are fully explained, these guidelines are what is in this handbook, issued just before the G.L.C. was abolished. It is not the purpose for which they were intended, but they will be of value in our library as a record of the appearance and use of the river from Hampton Waterworks to Dartford Creek as it was early last year, and also of the best opinion at that time of how appearance and use of the river ought to be conserved or improved. Uses considered include a due regard for 'ecology', i.e. nature conservation. The presentation of the guidelines, which have a map, a photograph or a drawing to explain every point, is faultless, the printing very nearly so, but where, I wonder, is the Loo Valley Regional Park?

The Greater London Development Plan is a dead letter now but the work on these guidelines will not go to waste. The London Planning Advisory Committee, which has to report before the end of this year to the Secretary of State who wants to produce a plan to replace the G.L.D.P., has set up a Thames-side Working Party with the same membership as the G.L.C.'s Consultative Committee on Thames-side Planning which was instrumental in their production, so there is hope that the Government will accept their principles, even if not all the borough planning committees have seen fit to do so.

R. M. Burton

Book Reviews

The Spiders of Great Britain and Ireland. By Michael J. Roberts. Harley Books, Colchester, Essex. **Vol. 1,** 1985, Atypidae to Theridiosomatidae, 229 pp, £45, ISBN 0 946589 05 4; **Vol. 2,** 1987, Linyphiidae and Check List, 204 pp, £45, ISBN 0 946589 06 2; **Vol. 3,** 1985, colour plates Atypidae to Linyphiidae, 256 pp, £55, ISBN 0 946589 07 0. Complete set, volumes 1-3, £135.

With the appearance earlier this year of Volume 2 this superb series is now complete and the author is to be heartily congratulated. When Dr Roberts started work on the colour plates in the late 1960s he had no plans for their publication although he was well aware that there was a need for an up-to-date illustrated work which would stimulate an even greater interest in the study of spiders than had built up in the past thirty years. However, by the late 1970s he contemplated the publication of his paintings and after their completion he commenced the line-drawings depicting the male palps and the female epigynes – both essential for specific identification – and then he added the text as he progressed.

We have come a long way since the pioneer days of Blackwall, who figured 330 species in his classic *A History of the Spiders of Great Britain and Ireland* (1861) and Pickard-Cambridge's *The Spiders of Dorset* (1879-81). Locket and Millidge's *British Spiders* (1951, 1953, 1974) was really the turning-point in the study of British and Irish spiders and the authors described and figured 557 species in the first two volumes and increased this to 611 species in the later, third volume. The present work describes 614 species and its aims are 'to make the identification of British spiders easier for established arachnologists, for beginners and also for those "occasional arachnologists" who may need to identify these animals during the course of other zoological or ecological studies'. It would be a severe critic who could not say that Michael Roberts has succeeded. This he has done admirably and another landmark in British arachnology has been created. But I am worried that the books have been so lavishly produced. They are intended for identification, for use at the bench, and for that reason the colour plates should have been reduced from their original, almost poster, size, and the heavy glossy paper is not the best type to use in the laboratory or in the field, where they are likely to get soiled by preservatives or by dirty hands. However, despite these criticisms, which are only minor, the author and publishers are to be congratulated in their venture.

K. H. Hyatt

The first 8 titles in the Shire Natural History series were reviewed briefly in the Society's January 1986 *Newsletter.* The series now has 23 titles published or planned and we have four of them before us: No. 10, *Lichens,* by Jack R. Laundon, No. 18, *The Adder,* by Peter Stafford, No. 19, *Butterflies of the British Isles; the Nymphalidae,* by Michael Easterbrook, No. 20, *The Brown Hare,* by Stephen Tapper.

Each consists of 24 pages, several of which are devoted to well-produced coloured illustrations, and the price of £1.25 represents good value by today's standards. The scope and consequently the depth of treatment varies greatly from booklet to booklet, some dealing with a single species of plant or animal, other covering whole families or even larger groups. All are excellent introductions to their subjects, giving us useful information on how we can observe, identify, conserve and enjoy them, with addresses of specialist organisations and suggestions for further reading for those whose appetites have been whetted and who wish to learn more. Colin Plant recommended the first 8 titles as worthy additions to our book-shelves and I have no hestitation in recommending the four here reviewed. I am now keen to see the remainder of the series.

Peter Holland

We have since received No. 21, *Ants of the British Isles,* by G. J. Skinner, No. 22, *Longhorn Beetles of the British Isles,* by Norman Hickin, and No. 23, *The Cuckoo,* by Ian Wyllie. Ed.

Hedgerows Surviving in Suburban Kingsbury

by L. R. Williams,* J. McLauchlin and T. G. Harrison

Summary

A survey of agricultural hedgerows and their remnants in the now suburban parish of Kingsbury in north-west London found 524 standard (timber) trees and over 14 kilometres of hedgerow representing 188 hedgerows. Twelve species of standard trees were found, most being oak *Quercus robur*. The results are discussed in relation to woodland and hedgerow loss in the parish.

Introduction

Numerous studies of rural hedgerows have now been published, but there is a lack of material on hedgerow surveys in suburban areas. A method described by Williams and McLauchlin (in press) uses standard hedgerow trees as an aid to locating surviving agricultural hedgerows and the positions of former hedgerows in suburban areas. This method depends on the survival of standard (timber sized) trees which were grown in hedgerows and were often left standing in back gardens, on small greens or in local parks during the development of suburban estates. The height and size of the standard trees make them especially useful, as they could often be seen above buildings which may obscure any other evidence of former hedgerows. In an attempt to survey the extent and wildlife value of surviving hedgerows in one parish, this method was applied in Kingsbury (area 744 hectares), now a suburban part of the London Borough of Brent. The parish is largely situated on London Clay and lies about 14 kilometres north-west of St Paul's Cathedral. This paper also includes a review of the known history of woodland and hedgerow in Kingsbury, so that the results can be discussed in this context.

Method

A survey of surviving hedges and standard trees was made in the parish of Kingsbury in 1986. To be defined as a hedgerow standard, a tree must have been part of or on the line of a former hedgerow as marked on the local 1864 Ordnance Survey or other maps dating from a period when the area was still rural. Each hedgerow standard fulfils most of the following criteria: a mature tree that was probably about its present size when the area became suburban (in the case of Kingsbury about 50-60 years ago), rise well above the shrubby component of a hedge, if present, and have a girth exceeding 150cm at 150cm above ground level. Some trees planted in gardens may also meet some of these criteria, and hence the importance of checking the results against an old Ordnance Survey map. For the purposes of this survey, a hedge would include any surviving shrubs, trees and earthworks between its intersections with adjacent hedges as shown on an old map. Estimates of the hedgerow length were made by pacing continuous sections of hedgerow shrub or rows of closely spaced standard trees. No length would be assigned to individual trees. Lengths of any hedgerow earthworks found, such as a bank and ditch, were also paced.

Maps used in this survey were the 1864 six-inch to the mile (9.5cm to the kilometre) Ordnance Survey map and the Hovenden maps of Kingsbury produced by All Souls College, Oxford in 1597. Scientific names follow Clapham, Tutin and Warburg (1981) wherever possible.

---

*Brent Leisure Services, London Borough of Brent, c/o Brent House, High Road, Wembley, Middlesex HA9 6UA.

Results

The survey found a total of 524 standard hedgerow trees (Table 1). Of these 191 where in the Kingsbury portion of Fryent Country Park (*c.* 65 hectares) where much of the hedgerow system is still intact (Williams and Cunnington 1985). The standard trees comprised 442 oak *Quercus robur*, 42 ash *Fraxinus excelsior*, ten crack willow *Salix fragilis* and another nine species accounting for the other 30 standards.

TABLE 1. Hedgerows surviving in Kingsbury, Middlesex, 1986.

	Suburban Kingsbury (including some local parks)	Fryent Country Park	Total for Kingsbury
Number of hedges found	136	52	188
Total length of hedgerow (m)	7,321	7,169	14,490
Total length of hedgerow earthwork (m)	4,988	6,256	11,244
Standard trees (numbers):			
Oak *Quercus robur*	281	161	442
Ash *Fraxinus excelsior*	24	18	42
Crack willow *Salix fragilis*	10	—	10
Field maple *Acer campestre*	3	4	7
Black Italian poplar *Populus* × *canadensis*	5	2	7
Horse chestnut *Aesculus hippocastanum*	5	—	5
Hornbeam *Carpinus betulus*	—	4	4
Common lime *Tilia* × *vulgaris*	2	—	2
Cherry *Prunus* spp.	2	—	2
Wild service tree *Sorbus torminalis*	—	1	1
Common pear *Pyrus communis*	—	1	1
Beech *Fagus sylvatica*	1	—	1
Total number of standard trees	333	191	524

Surviving hedgerow totalled an estimated 14,490 metres, just under half being within Fryent Country Park. Over 30 species of trees and shrubs were identified. Oak was the most frequent species occurring in 80% of the 188 hedgerows that were located. The hawthorns *Crataegus monogyna, C.* × *media* and *C. laevigata*, blackthorn *Prunus spinosa*, dogwood *Cornus sanguinea*, crab and apple *Malus* spp. occurred frequently in the Fryent Country Park hedgerows, but were less common in the suburban hedgerows. Wild roses *Rosa* spp. were recorded in 50% of the Country Park hedgerows but in only 3% of the other hedges. Uncommon species such as spindle *Euonymus europaeus*, wild service tree *Sorbus torminalis* and wild privet *Ligustrum vulgare* were confined to Fryent Country Park.

English elm *Ulmus procera* suckers were widely distributed, occurring where standard elm trees had stood prior to Dutch elm disease. Wych elm *U. glabra* was found only in three hedges in the south-east of the parish. Yew *Taxus baccata* and holly *Ilex aquifolium* were confined largely to hedgerows around the 13th century Old St Andrew's churchyard, while an alder *Alnus glutinosa* was recorded on a hedgerow alongside the River Brent. Crack willow *Salix fragilis* was often found alongside the River Brent or on streamsides. Garden escapes and introductions were more frequent in the suburban hedges; for example sycamore *Acer pseudoplatanus* was not found in any of the Fryent Country Park hedgerows although it occurred in 26 (19%) of the other hedgerows. Other introductions included Norway maple *A. platanoides*, various *Populus* species, garden privet *Ligustrum ovalifolium* and snowberry *Symphoricarpos rivularis*.

Horse chestnut *Aesculus hippocastanum*, hornbeam *Carpinus betulus* and beech *Fagus sylvatica* were introduced by Humphry Repton in a 1793 landscaping scheme in which a belt of trees was planted alongside an existing hedgerow. These three species, together with common lime *Tilia* × *vulgaris* were also planted in existing hedgerows elsewhere in the parish during Victorian and subsequent periods.

The other species recorded were field maple *Acer campestre,* cherry *Prunus* species, Swedish whitebeam *Sorbus intermedia,* common pear *Pyrus communis,* silver birch *Betula pendula,* hazel *Corylus avellana,* various poplar *Populus* and willow *Salix* species, and elder *Sambucus nigra.*

Earthworks, usually a bank and ditch were associated with 11,244 metres of the hedgerow length. Some of the parish hedges in Fryent Country Park and on the Welsh Harp Open Space had two banks and a central ditch.

Review of Woodland and Hedgerow History

Bolton (1976) has summarised the few records of woodland history in Kingsbury. In the Domesday Survey of 1086, Kingsbury was divided between two holdings with enough woodland for 1,000 pigs on the main estate and for another 200 pigs on the smaller Westminster Abbey estate. Rackham (1980) has estimated that for those eastern England counties in which woodland was assessed on the basis of the number of pigs that it could support, each pig represented at least one acre (0.41 hectare) of woodland. Therefore 1,200 pigs would correspond to at least 485 hectares of woodland. There is considerable debate (Rackham 1980) about the interpretation of Domesday records and the original assessments were often in rounded figures, for example those above. Pinder (1969) suggests that for farmland, many of the Middlesex Domesday assessments add up to, or are exact multiples of five hides, such as the 7½ and 2½ hides in the small parish of Kingsbury. Estimates of the area of arable land and woodland in Kingsbury total considerably more than the actual area of the parish. For the purposes of this discussion woodland probably occupied at least 65% of the parish. Even this was high as compared with the average of 15% for Domesday England and 30% for Middlesex (Rackham 1980). Pinder (1969) and Darby and Campbell (1962) summarise how the Domesday Survey indicates a densely wooded area in the north and north-west of the county including Kingsbury. The Westminster Abbey estate (in the south of the parish) described in 1044-50 as wood held in common, had by *c.* 1200 become common pasture suggesting considerable clearance (Bolton 1976). By 1438 the All Souls College records indicate further clearance elsewhere in the parish from an area primarily of woodland to one in which separate woods were surrounded by other land uses.

The Hovenden maps of Kingsbury produced by All Souls College in 1597 cover most of the parish area. These maps show an assart landscape in which fields had been cut out of the original forest, leaving some woodland and a large number of woodland belts around the fields. Estimating the area of woodland remaining is made difficult by a range of woodland, woodland belts and hedgerows of various widths. Bolton (1976) suggests that woodland, mostly in bands around fields, comprised rather more than 11% of the known area of the parish. This is a reasonable estimate for the woodland; but if all belts of woodland and hedgerow are included this figure is revised to 22% with 78% of the known area of the parish as field (L. R. Williams estimate). This figure corroborates Garrett's (1935) statement that the All Souls College records for 177 hectares of their Kingsbury estate in the years 1590-1650 show woodland to cover 26% of the estate with arable, pasture and meadow accounting for 73%. By 1729-38 woodland only occupied about 4% of the parish, falling to about 1% in 1819 and to 0.2% in 1839. Rackham (1980) notes that Middlesex lost a higher proportion (93%) of its 1086 woodland between then and 1895 than any other English county. As the woodland declined, so the vast majority of trees in the parish only occurred in hedgerows.

It can be estimated from the 1864 Ordnance Survey map that there were 80 kilometres of hedge in Kingsbury (L. R. Williams estimate). If hedgerows had an average width of three metres, this could be equivalent to 24 hectares or 3% of the parish area. Most of these hedges were in the same positions as those shown on the 1597 map, though a few had been planted. There was no Enclosure Award for Kingsbury.

The length of hedgerow surviving in 1920 was probably similar to the 1864 figure, but there would have been a large loss of farmland and hedgerow between 1920-40 corresponding to the rapid spread of suburbia in the vicinity of London. Some hedges were retained amongst the new estates and still survive today where they have not been lost to development during the past fifty years. From the results of the survey reported here, the hedgerows may now occupy between 4-6 hectares, or less than one per cent of the parish area, though it is difficult to estimate an average width.

Discussion

These results show how an inventory can be made of surviving standard hedgerow trees and hedgerows within a suburban area. In addition to their wildlife value, these trees are important for amenity reasons and in providing a living link with the past. The shrub and tree composition of Kingsbury hedges in the rural state is known from the results of this and an earlier survey of Fryent Country Park (Williams and Cunnington 1985). While these hedges contain some species indicating a woodland origin, for example hazel, wild service tree and woodland hawthorn, the composition would have been much affected once they were managed as hedgerow. Species producing large timber, especially English oak, ash and English elm *Ulmus procera* would have been planted into the hedges, though many were probably promoted from young trees.

Should adjacent parishes be surveyed in future years, it should be noted that the parish boundary hedge lengths are shared. On the west side of the parish, the boundary with Harrow (Wembley) is well preserved where it passes through Fryent Country Park. A section of this hedge served as part of the ancient Eldestrete trackway, Braun (1937*a* and *b*).

The method used here is probably reliable in locating a large majority of hedgerow remnants, but some hedges may be missed where obscured by housing. This would be especially true of shrub-sized trees. It may be noted that standard trees were found in 149 (79%) of the 188 hedgerows. In 107 of these there were oak standards only and in another 36 oak occurred with other standards.

There are various explanations why individual trees have survived in their present location. These include the retention of ownership boundaries where hedgerow trees would seldom be an obstruction to development. Developers themselves often realised the value of retaining trees on estates as an attraction to potential house buyers. Planning regulations have also had a role in saving trees. Recently much has been written about the technical aspects of tree protection in urban areas and on development sites (Hebblethwaite 1980 and Helliwell 1985), although the origin of the trees from old hedgerows is seldom mentioned. If these trees are to continue to be retained in urban areas for their amenity and landscape value, then conservation measures will be required. Special problems include the ageing of the trees, building extentions and infill developments. The British Standards Institution (1980) and the National House-Building Council (1985) provide further guidelines and note that the precautions given in their Practice Note will allow trees and hedgerows to grow alongside homes without increasing the risk of undue movement in the structure.

Considerable value will be gained in locating these hedgerow trees, publicising this information and encouraging residents to take an interest in their conservation. Protection may also be sought through Tree Preservation Orders and in Conservation Areas. Few of the Kingsbury trees have this protection. There is also the question of replacement when the standards die or have to be removed on safety grounds. At present few of these trees are being replaced. If the conservation value is to be retained replacement trees of the same species should be planted nearby, preferably long before the original tree is removed.

The wildlife value of remnant hedgerows within suburban areas is not well documented. With over 14 kilometres of hedgerow and 524 standard trees, there is considerable habitat available for wildflowers, insects, small mammals and birds. This paper shows how much hedgerow habitat still survives in a suburban area and the results could be extrapolated to give an indication of the extent of this habitat throughout London. The production of hedgerow inventories for whole boroughs would contribute towards the conservation of wildlife in London.

Acknowledgements

We would like to thank members of the Brent Group of London Wildlife Trust and others who participated in this survey including M. F. Andre, J. J. Delhanty, Sharon Harrison, Kathy Northcroft and Mrs Tansley.

References

BOLTON, D. K. 1976. Kingsbury. In: Baker, T. F. T. (Ed.) *The Victoria History of the Counties of England. A History of Middlesex.* **5:** 49-88. The University of London Institute of Historical Research. Oxford University Press.

BRAUN, H. 1937*a*. The Hundred of Gore and its Moot-Hedge. *Trans. Lond. Middx. Arch. Soc.* **7:** 218-28.

BRAUN, H. 1937*b*. Some earthworks of north-west Middlesex. *Trans. Lond. Middx. Arch. Soc.* **7:** 365-92.

BRITISH STANDARDS INSTITUTION. 1980. *Code of practice for trees in relation to construction.* BS5837. British Standards, London.

CLAPHAM, A. R., TUTIN, T. G. and WARBURG, E. F. 1981. *Excursion Flora of the British Isles.* Cambridge University Press, Cambridge.

DARBY, H. C. and CAMPBELL, E. M. J. 1962. *The Domesday Geography of England – South-East England.* Cambridge University Press, Cambridge.

GARRETT, A. J. 1935. *The Historical Geography of the Upper Brent.* M.A. Geography degree thesis. University of London.

HEBBLETHWAITE, R. L. 1980. The conservation of trees and shrubs in built-up areas. *Jl Devon Trust for Nature Conservation* (Suppl.) Exeter.

HELLIWELL, D. R. 1985. *Trees on Development Sites.* Arboricultural Association.

NATIONAL HOUSE-BUILDING COUNCIL. 1985. *Building Near Trees.* National House-Building Council, Amersham.

PINDER, T. G. 1969. Domesday Survey. In: Cockburn, J. S., King, P. F. and McDonnell, K. G. T. (Eds) *The Victoria History of the Counties of England. A History of the County of Middlesex.* **1:** 80-138. The University of London Institute of Historical Research. Oxford University Press.

RACKHAM, O. 1980. *Ancient Woodland: its History, Vegetation and Uses in England.* Edward Arnold, London.

WILLIAMS, L. R. and CUNNINGTON, W. 1985. Dating a hedgerow landscape in Middlesex: Fryent Country Park. *Lond. Nat.* **64:** 7-22.

WILLIAMS, L. R. and McLAUCHLIN, J. (in press). A method for tracing old hedgerows in suburban areas using standard trees. *Local Historian.*

Book Review

Britain's Natural Heritage. Reading our countryside's past. By Phil Colebourn and Bob Gibbons. 1987. Blandford Press. £14.95. ISBN 0 7137 1750 5.

This is a very readable account of the natural history of Britain since the end of the last ice age, 18,000 years ago. There is a great deal of interesting information on the geology, vegetation and animal life, and the way our richest wildlife habitats have developed and been modified by man's influence, and how the plants and animals in them have changed. It is explained how some of these changes can be 'read' from what can be seen in the countryside around us now. There are numerous illustrations, finely produced and many of them in colour; especially excellent are the whole-page colour photographs. Also there are old maps and aerial photographs.

The book is full of fascinating information. Some examples may be given. Farming, including the keeping of cattle and sheep, was going on in Neolithic times, 6,000 years ago, while ploughing can be traced back 5,000 years. Farming increased and by the Iron Age, 3,000 years ago, there was an intensively farmed landscape. Some of the boulder-filled Cornish hedge-banks were made in the Bronze Age, 4,000 years ago, and even parish boundaries are often of great age, many probably originating in Roman estates. Woods, which are descended from the wildwood, are suggested by the presence of butcher's broom growing with wood spurge. We learn that there are certain indicator plants for old woodland and old meadowland, and that the more of these there are, the more strongly they suggest that the type of vegetation is ancient. By the eleventh century there was already a great deal of downland in chalk country in Dorset and on Salisbury Plain; and some areas of downland had been unploughed since the Black Death (bubonic plague) over 600 years ago. The undisturbed presence of Iron-Age relicts and the absence of later plough marks indicate that many sites have been grassland for 2,000 years or more. Old downland has more species of plants than more recent downland, and hence more species of butterflies, whose larvae feed on different plants. Evidence suggests the probability that Mesolithic man (8,000 years ago) created heath from hazel scrub and woodland, probably with the help of fire, almost certainly to herd wild or semi-domesticated animals. Remains of some of the earliest wooden roads in the world (neolithic) have been found in the Somerset Levels. Where there are now the Norfolk Broads, peat was extracted from 930 A.D. until a great flood in 1287, after which most were abondoned. But now, in the last twenty years, from being a healthy water system, most aquatic plants have gone, due to pollution by fertilizers run off from agricultural land, perhaps with the addition of hydrocarbons from boat traffic.

The last chapter deals with conserving the natural heritage and concludes with – 'In the last forty years we have lost a very large part of the natural heritage of Britain that has taken thousands of years to develop. The sooner we can do something to prevent the remainder from disappearing the better.'

There are appendices on the classification of woodland types and on the plants of ancient woodlands, and there is also a short bibliography. This book is strongly recommended to anyone interested in the development of the British countryside.

GEOFFREY BEVEN

Distribution and Status of Bats in the London Area

by SIMON MICKLEBURGH*

Contents

Summary 41
Introduction 41
Identification and Acceptability of Records 42
Sources of Records 42
Summer Roost Site Survey 43
Winter Roost Sites 43
Feeding Area Survey 45
Species Accounts 46
Conclusions 55
Distribution Maps 56
Acknowledgements 68
References 68
Appendices 73
  Appendix 1 Roost Sites in the L.N.H.S. Area, 1950-86 73
  Appendix 2 Results of Feeding Area Survey, 1985-86 81
  Appendix 3 Contributors to the Feeding Area Survey, 1985-86 89
  Appendix 4 Example of Feeding Area Survey form used in 1985-86 90

Summary

The complete results of the 1985-86 London Bat Project are presented covering investigation of summer and winter roost sites and feeding areas. Of the 137 new summer roosts listed, 75 are of pipistrelles *Pipistrellus pipistrellus*. Our records combined with those collected over the past 36 years, give a total of 430 summer roosts in the L.N.H.S. area. The survey of feeding sites again showed the abundance of pipistrelles and revealed that noctule *Nyctalus noctula* or Leisler's bats *N. leisleri* were also widespread. More than 700 visits were made to over 450 sites and bats were found feeding at 397 of these. The winter hibernacula survey looked at 106 sites, but only 28 were found to be used by bats and 70% of these were used by fewer than six bats. In the period 1960-86, 14 species of bat have been recorded from the L.N.H.S. area and 11 species were recorded during the 1985-86 survey.

Introduction

Prior to 1985, information about the status and distribution of bats in the London area was patchy. Hooper's excellent survey (Hooper 1970, 1977, 1981) showed the wide-ranging occurrence of bats, especially pipistrelles, in the south-west area of London. Many of the earlier accounts (e.g. Beames 1968, Hancock 1964, and Teagle 1965) concentrated on winter hibernation sites in Surrey and Kent. However, many areas of London, particularly the north and east, remained virtually unsurveyed, and there was very little information on summer roost sites for the whole of the London area.

The London Bat Project was set up in December 1984 as a one-year scheme with funding from the Greater London Council to collect information about bat feeding areas and roosting sites throughout the G.L.C. area (the boundary of this area is shown in Map 1). From January to April 1986 funding was continued by the London Natural History Society. From April until December 1986 funding came from the London Boroughs Grants Scheme.

The information presented here represents the full results of the London Bat Project for 1985 and 1986. These data are combined with those from previous studies to give a complete picture for the period 1960-86. Historical information on bat records is also given, and species accounts include, for the first time, a complete set of distribution maps for bats in the London area.

---

*Fauna and Flora Preservation Society, 8-12 Camden High Street, London NW1 0JH.

Systematic sequence follows Corbet (1978). Scientific names are given under the species accounts.

Identification and Acceptability of Records

Bats are extremely difficult to identify. In flight, one rarely gets a clear view of the animal. Even in the hand the identification of some species can be difficult, but the recent publication of several books and guides can help the beginner (Stebbings 1986, Yalden 1985, Richardson 1985, Corbet and Southern 1977). Problems of identification have led to discussions over the acceptability of records. Records can be of several kinds; in decreasing order of acceptance, they are:

1. **A Specimen.** The most acceptable record is an actual specimen. In the past bats were sometimes obtained by shooting. Fortunately today's methods are not so destructive. Live specimens for identification can be obtained at roost sites or feeding areas using various netting and trapping techniques. However, even in the hand some bat species can be misidentified.

2. **Evidence at Roost Sites.** Bat droppings are often encountered at roost sites, and both the droppings themselves and their situation can be used to identify the species. The position of roosting can also help in identification, since some species have preferred roosting sites (e.g. noctules prefer trees and serotines prefer buildings), though it is not unknown to find bats roosting in atypical places!

3. **Bat Detector Records.** Over the past few years there has been increased use of bat detectors, instruments which pick up the ultrasonic emissions of bats and convert them into sounds audible to humans. There are several models on the market, the most widely available being the QMC Mini (QMC Instruments Ltd). These instruments can be very useful tools, though their use in bat identification takes practice. Hooper (1981) used a more sophisticated bat detector, and discussed the use of those machines and some of the problems associated with them.

4. **Flight Records.** Flight records of bats are generally unacceptable unless by a proven expert.

In some published accounts only category 1 records have been accepted, but this often results in a very small number of records and the consequent loss of information on the distribution of bats in general.

In this account the following criteria have been used in accepting records:

- No purely flight records of species have been accepted, though they appear on the Bat Records 1960-86 map (No. 22).
- Where a bat detector has been used, no records are accepted where the bat or bats were not seen. The experience of the observers has been taken into account with some identifications.
- Where identifications have been made using droppings or specimens, these have been verified by an expert.

The distribution maps for the commoner species indicate the method by which the records were obtained, i.e. specimens, roost visits and flight with bat detector.

Sources of Records

Apart from published literature on bats, the other main sources of records were from the Nature Conservancy Council (N.C.C.), the Biological Records Centre (B.R.C.) at the Institute of Terrestrial Ecology (I.T.E.), Monks Wood, the L.N.H.S. and other bat groups and individuals. All bat records are lodged with the L.N.H.S.

Summer Roost Site Survey

Prior to this survey there was little information on London's summer bat roosts. Roost site information in this survey came from two main sources:

1. The Nature Conservancy Council. Under the Wildlife and Countryside Act (1981) anyone with bats who intends to proceed with an operation that may disturb them, or wishes to have them removed must contact the N.C.C.
2. Reports from people who have bats, and are quite happy with them.

During the survey 137 new roosts were discovered. Appendix 1 lists these together with other known roosts in the L.N.H.S. area since 1950, compiled mainly from information kept by the N.C.C. and the I.T.E. Map 2 shows the distribution of roosts. A total of 430 roosts was located, 166 in Greater London, 120 in Surrey, 31 in Kent, 47 in Essex, 62 in Hertfordshire and four in Buckinghamshire. Positive identification of species was made at 186 sites and of these 138 (74%) were pipistrelle, 21 (11.5%) serotine, 18 (10%) brown long-eared, six (3%) noctule, two (1%) Daubenton's and one (0.5%) Brandt's.

The distribution map reveals a large area of central and eastern London with few roosts. This may reflect more the lack of suitable feeding areas than of potential roost sites. The south-western area of London is heavily used, as would be expected from its abundance of excellent feeding habitats. A similar situation exists in west London. Appendix 1 reveals several areas that are notable for their large numbers of roosts: Ickenham, Walton and Sunbury-on-Thames, Putney, Weybridge, Leatherhead, Harlow, St Albans and Watford. These are all on the outskirts and may have a larger proportion of new housing, which may be more attractive to the main roosting species, the pipistrelle. It is surprising that only 21 serotine roosts were found; it is very much a southern species in Britain and favours buildings almost exclusively. The fact that only six noctule roosts were found reflects the difficulties of finding tree roosts. The low number of brown long-eared bat roosts is very surprising, particularly considering their abundance in neighbouring counties. Only two Daubenton's roosts are recorded: the Uxbridge house roost was blocked in 1977, unfortunately, and the roost in a cave in Chipstead, Kent was recorded between 1979 and 1981 but has not been seen since. Although 430 roosts are listed in Appendix 1, a proportion will have been lost either by disturbance at or destruction of sites or by blocking of entrance and exit holes.

Winter Roost Sites

Many earlier accounts concentrated on the well-known winter sites around Godstone in Surrey and Westerham in Kent. However, within the G.L.C. area virtually no information was available. Table 1 summarizes the survey results. A

TABLE 1. Hibernation Sites. List of types of sites visited and number used by bats.

Type of site	Number visited	Number used by bats
Ice-houses and Ice-wells	27	2
Mines (chalk, sand and stone)	19	10
Tunnels (railway, canal and other)	15	1
Air-raid shelters	7	2
Deneholes	7	5
Lime-kilns	2	2
Forts	3	1
Miscellaneous[1]	26	5
TOTAL	106	28

[1] Disused stations, grottos, well-houses, conduit, underground bunkers, gunpowder mills, disused church, pumping station, filter beds, quarry workings.

total of 106 potential sites was investigated: 12 sites had been completely destroyed or were too damaged to be suitable for use by bats; 15 sites were not accessible to humans so their status for bats was not known. This left 79 sites that were potentially usable by bats and 28 of these (35%) were found to be used including some already known sites. Mines and deneholes were most favoured, accounting for over half the known roosts. Ice-houses, despite being the most numerous type of potential roost site, were used only in two cases. Many of the ice-houses investigated were in a poor state of repair or had been totally demolished. Only five winter hibernation sites were found within the G.L.C. area, four were located in Bromley and Bexley and one in Harrow. The best of these sites contained only eight bats, though these were of four different species.

Table 2 summarizes the information on species using hibernation sites. Identifications are available for 25 of the 28 known sites. Greater horseshoe, lesser horseshoe and barbastelle bats are now extremely rare species and this is reflected in the dates of the records. Apart from the single 1986 greater horseshoe record, all others for these three species are pre-1969. Greater horseshoe bats have only been recorded in hibernation sites five times this century, lesser horseshoe three times and barbastelles twice. The most ubiquitous species was brown long-eared, present at 76% of sites, followed by Daubenton's and Natterer's at 72%, and whiskered or Brandt's at 40% of sites. However, while present at many sites, brown long-eared, whiskered and Brandt's are not found in large numbers, and in terms of abundance Daubenton's and Natterer's far outweigh all other species. All of these species are found rarely in the summer. Conversely, the commonest found in summer, the pipistrelle and the noctule, are rarely seen in winter, since the sites they favour (i.e. buildings and trees) are extremely difficult to check for their presence.

TABLE 2. Hibernation Sites. Species using hibernation sites. Number of sites = 25.

Species	Number of sites with species	% of sites with species
Greater horseshoe bat[1]	4	16
Lesser horseshoe bat[2]	2	8
Whiskered bat	5	20
Brandt's bat	6	24
Whiskered, Brandt's and Whiskered/Brandt's[4]	10	40
Natterer's bat	18	72
Daubenton's bat	18	72
Northern bat	1	4
Barbastelle bat[3]	2	8
Brown long-eared bat	19	76

1 Dates of records: 1986, 1964, 1951, 1949, 1902
2 Dates of records: 1935, 1917, 1902
3 Dates of records: 1968, 1965, 1874, 1859
4 Includes records where species were separated and those where no separation was made.

Table 3 shows the number of species found at the sites. Information is available for 25 of the 28 known sites. Between one and three species were found at 72% of

TABLE 3. Hibernation Sites. Numbers of species using sites. Number of sites = 25.

Number of species	Number of sites	% of sites
1	5	20
2	5	20
3	8	32
4	2	8
5	2	8
6	3	12

sites. Three sites had six species present; one included greater and lesser horseshoe and barbastelle, one greater and lesser horseshoe and one greater horseshoe. While two of these sites are still of great importance, the third, Chislehurst Caves, is now probably rarely used by bats due to disturbance. In the 19th Century this site could boast both horseshoe bats and barbastelles and was regularly mentioned in the bat literature as a 'chalk cavern near Chislehurst'.

Table 4 shows the number of bats using the sites. Information is available for 27 of the 28 known sites. The results are quite startling: 70% of the sites are used by a maximum of fewer than six bats, only three sites (11%) are known to be used by more than 20 bats and only one site (4%) by more than 50. Many of the known sites are threatened, usually by disturbance, though some of the more important sites have either been protected or will be protected in the future. In the case of Westerham, protection has lifted it to being one of the most important sites in the south-east. These results do show the importance of sites used by small numbers of bats, but also the low rate of usage of potential sites (only 35%), usually because of disturbance.

TABLE 4. Hibernation Sites. Numbers using sites. Number of sites = 27.

Maximum number of bats	Number of sites	% of sites
1–5	19	70
6–10	4	15
11–20	1	4
21–50	2	7
50+	1	4

The figures given here are often based on a small number of winter counts. The numbers of bats using a site can vary significantly throughout the winter, often depending on prevailing weather. The difficulty of searching some sites also means that the figures may represent only a small proportion of the numbers present.

Feeding Area Survey

Surveying feeding areas is a relatively simple way of assessing the status of the bat population of an area. Hooper (1981) and Martin (1986) made use of bat detectors to survey their local areas. In both cases pipistrelles were shown to be the most abundant and widespread species.

The 1985-86 survey was designed to cover areas mainly within the G.L.C. boundary. Survey forms (see Appendix 4) were produced to provide information about site location, number of visits, numbers and species of bats seen and weather conditions at the time of survey.

Appendix 2 summarizes the results. Sites are split primarily by borough and secondarily by grid reference. A 'site' is considered to be an area within a 1-km National Grid square. Thus one 1-km square may contain several 'sites'. A large area such as Hampstead Heath, which covers several 1-km squares is also considered to be made up of several 'sites'.

Over 700 visits were made to 452 potential feeding sites; of these, 397 (88%) were used by bats. Positive identification of species was made at 107 sites (27% of the total). Ninety-three of these sites (87% of the total) were used by pipistrelles, 52 (49%) by noctule or Leisler's, 15 (14%) by Daubenton's and seven (6%) by serotine. Fifty-nine (55%) of these sites were used by one species, 37 (35%) by two, nine (8%) by three and two (2%) by four. Estimates of bat numbers present were made at 340 sites and out of these fewer than five bats were seen at 255 sites (75%), between six and 20 were seen at 73 sites (21%) and only 12 sites (4%) were used by more than 20 bats. Estimating bat numbers is difficult and repeated visits would be required for confirmation, but these figures suggest that the majority of sites in London are used by small numbers of bats.

The distribution of sites visited is shown on Map 3. Several boroughs were well surveyed by local groups, but we still know little about some areas of south-east and north-east London. From the map it is obvious that the greatest density of feeding records is in south-west and north London, the Borough of Richmond probably ranking as the best for feeding bats. The top ranking areas of London in terms of numbers and diversity of species are:

Hampstead Heath
Richmond Park
Osterley Park
Berwick Pond
Hyde Park
Regent's Park
Wimbledon Common

The importance of the many less well used sites should not, however, be underestimated.

A total of 66 visits was made to 55 sites where no bats were found. In the majority of these cases the sites were close to others known to be used by bats, and the absence of bats at these sites may simply have been due to weather conditions at the time of survey.

The feeding areas most heavily used by bats were those that had a diversity of habitats, including water and wooded areas. The poorer sites often had only small areas of suitable feeding habitat in an otherwise unattractive landscape. Several of the central London parks were, surprisingly, heavily used. On the other hand, it is surprising that so few bats were seen along the eastern stretches of the Regent's Canal and along the limited stretches of the rivers and reservoirs of the Lea Valley where access was possible.

Species Accounts

For each species a very brief account of its British distribution is given. This is followed by a summary of historical records from the London area. Where relevant, a discussion of the 1985-86 results follows and each account finishes with a list of references additional to those already mentioned. Bechstein's bat *Myotis bechsteinii* and grey long-eared bat *Plecotus austriacus* have never been reported from the L.N.H.S. area.

GREATER HORSESHOE BAT *Rhinolophus ferrumequinum.* Map 4.

One of Britain's rarest species, now confined largely to the south-west. Greater horseshoe records are sparse: Oxleas Wood 1953 (Rigden 1955), Godstone 1951 (D. L. Harrison L.N.H.S. unpubl.), Reigate (Vesey-Fitzgerald 1949), Chislehurst Caves 1949, Berkley Square 1948, Beulah Hill around 1940, Regent's Park 1933-39 and Hayes, Kent 1904 (Fitter 1949). Bucknill and Murray (1902) describe it as 'rare' at Godstone. One of the oldest of all London's bat records is of a greater horseshoe discovered by Latham at the powder mills in Dartford (Pennant 1776-7).

A more recent record from just outside the L.N.H.S. area was one at Box Hill in 1964 (Beames 1968). A greater horseshoe found hibernating in the same area in the 1985-86 winter was thus the first record for over 20 years. It is not inconceivable that this animal was the same one found in 1964. It seems unlikely that this species still breeds in Surrey, but more likely that it is a stray from existing populations to the west. However, the search for more individuals will continue with renewed vigour.

Other references:
Baker 1908, Barrett-Hamilton and Hinton 1910-21, Bell 1837, 1874, Bingley 1809, Findon 1913, Harting 1887, Livesley 1969, Millais 1904-6, Soames 1895, Stubbs 1917, Tutt 1909.

Lesser horseshoe bat *Rhinolophus hipposideros*. Map 5.

A very rare species now confined to south-west Britain. The last authentic record in the London area was Abbey Wood, Woolwich in 1952-53 (Rigden 1955). Earlier records were pre-1940: Hyde Park and Kensington Gardens 1936-39, Godstone 1935, Regent's Park 1924-27 (including two found in the porch of H. G. Wells' house in 1926), and Chislehurst Caves 1917 (Fitter 1949). Barrett-Hamilton and Hinton (1910-21) describe it as 'frequent in Kensington Gardens', Millais (1904-6) gives its distribution as from Maidstone to Chislehurst, while Bucknill and Murray (1902) describe it as 'not rare' at Godstone. The earliest record is in the neighbourhood of Sevenoaks, Kent in 1886 (MacPherson 1887).

Other references:
Crossman 1902, Livesley 1969, Stubbs 1917, Wilmore *et al.* 1925.

Whiskered bat *Myotis mystacinus* (Fig. 1) and Brandt's bat *Myotis brandtii*. Maps 6, 7 and 8.

Brandt's bat was only recognized as a species distinct from the whiskered bat in 1971 and their separation still poses serious difficulty. Both species are probably present throughout England and Wales. All pre-1971 records must also include some Brandt's bats. The majority of records since 1950 have been from winter

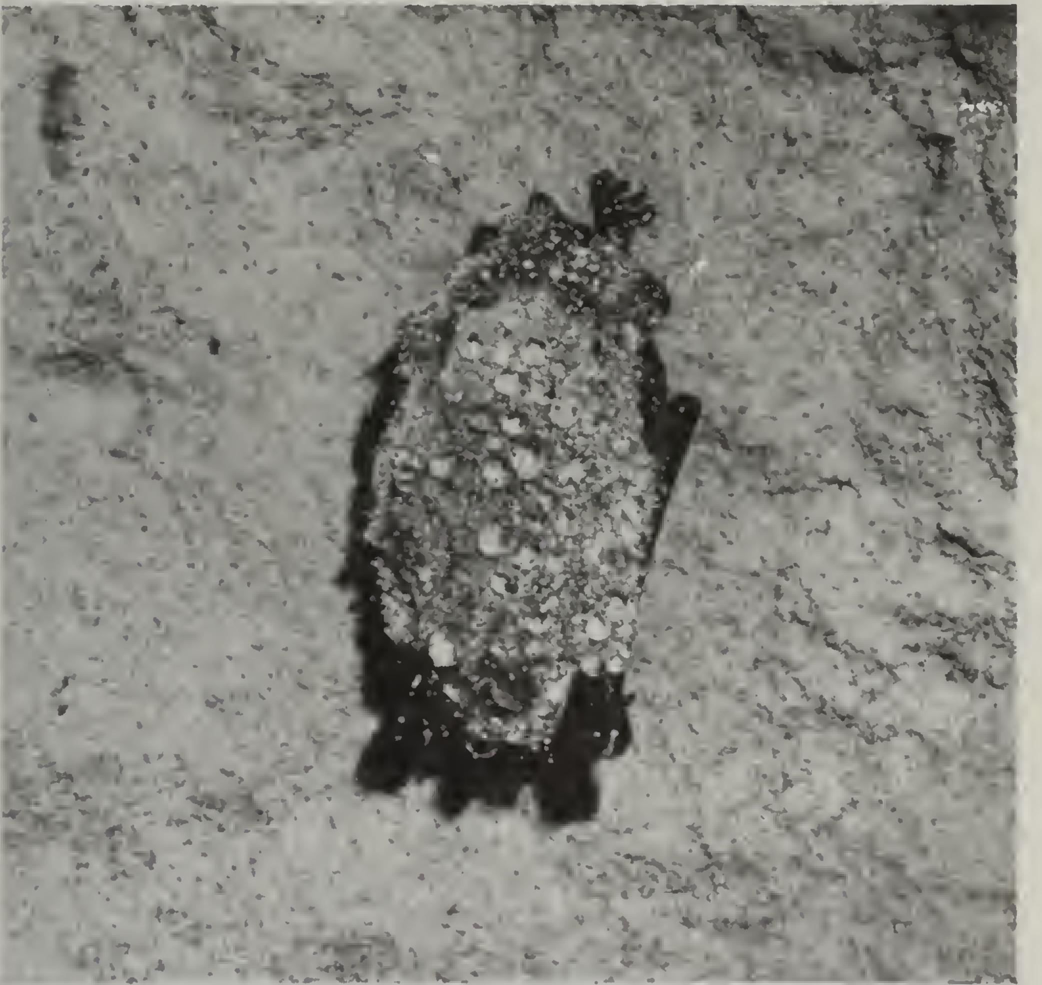


Fig. 1. Whiskered bat *Myotis mystacinus*. Hibernating at Westerham, Kent. The appearance is due to droplets of water which have condensed on the bat's fur as a result of a significant drop in body temperature. *Photograph copyright Frank Greenaway.*

hibernation sites in Surrey and Kent. Fitter (1949) recorded that whiskered bats were widespread in London suburbs and beyond. He noted records from Dulwich, Streatham, Wimbledon, Southall, Mill Hill, Hendon and Highgate between 1921 and 1945. He also had an earlier record from Whitechapel in 1917. Earlier records include Chislehurst (Bell 1874, Collingwood 1859) and Epping Forest 1841 (Doubleday 1843). There have been few positive Brandt's records. Since 1974 they have been recorded from winter sites at Westerham, Godstone and Betchworth. A single summer roost is known in a house in Uxbridge.

All whiskered or Brandt's records during the survey were from winter hibernation sites in Greater London, Kent and Surrey. In many cases no attempt is made to separate these species in the field. They were found at 40% of known hibernation sites and are surprisingly widespread in comparison with neighbouring counties.

Other references:

Baker 1908, Barrett-Hamilton 1906, Barrett-Hamilton and Hinton 1910-21, Beames 1968, 1969, Bell 1837, Bucknill and Murray 1902, Burton 1966, 1974, Cocks 1905, Fitter 1960, Hancock 1964, Harting 1888, Laver 1898, 1903, Livesley 1969, Lydekker 1895, Macgillivray 1838, Millais 1904-6, Rigden 1955, Seear 1964, Stubbs 1917, Teagle 1964, 1965, Tinning 1963, Tutt 1909, Webb *et al.* 1899, Woodroffe and Southgate 1951.

NATTERER'S BAT *Myotis nattereri*. Map 9. (Fig. 2).

This species is widespread in the British Isles. In the London area since 1950 it has been recorded almost exclusively from winter sites in Kent and Surrey. Fitter (1949) could find no recent records of Natterer's bats. He recorded that it had been 'fairly common in the suburbs' in 1917 and 'common in Hampstead' in 1913. Earlier records were from Chislehurst in 1908 and 1909 and from Regent's Park in 1904. Harting (1889b) listed Natterer's as having been procured at Hampstead, Edgware, Stanmore and central London (Thayer Street, Manchester Square and around the British Museum). Other records include Epping Forest 1841 (Doubleday 1843) and Chislehurst (Bell 1837).

A dead Natterer's bat was found in Highgate Wood in December 1985. Almost

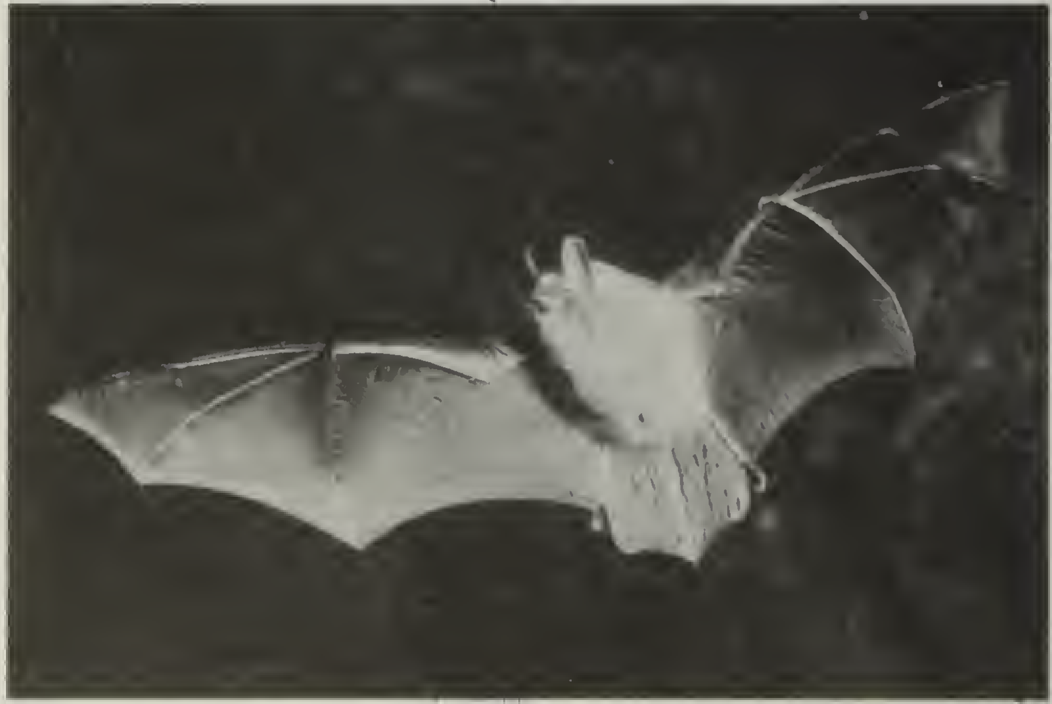


FIG. 2. NATTERER'S BAT *Myotis nattereri*. The bones, muscles and blood-vessels of the wings and tail are clearly visible in this shot. *Photograph copyright Frank Greenaway.*

all of the remaining records have come from hibernation sites. Natterer's is one of the most commonly recorded species in winter sites, found at 72% of known sites.

Other references:
Baker 1908, Barrett-Hamilton and Hinton 1910-21, Beames 1968, 1969, Bell 1874, Borrer 1874, Bucknill and Murray 1902, Burton 1966, 1974, Chapman and Hammond 1962, Clark 1979, Cocks 1905, Corke 1984, Dobson 1984, 1985, 1986, Findon 1913, Fitter 1960, Gray 1825, Hancock 1964, Laver 1898, 1903, Livesley 1969, Lydekker 1895, Macgillivray 1838, Millais 1904-6, Pickess 1955, Rigden 1955, Seear 1964, Stubbs 1917, Tinning 1963, Teagle 1965, Tutt 1909, Webb *et al.* 1899, Wilmore *et al.* 1925.

MOUSE-EARED BAT *Myotis myotis.*

This species is effectively extinct in Britain with only a single bat known to roost in Sussex. It was said to occur in Epping (Doubleday 1843) and was supposedly found in the gardens of the British Museum, Bloomsbury prior to 1835 (Bell 1837). Neither of these records was accepted by Barrett-Hamilton and Hinton (1910-21).

Other references:
Bell 1874, Lydekker 1895, Millais 1904-6.

DAUBENTON'S BAT *Myotis daubentonii.* Maps 10 and 18. (Fig. 3).

A common species widely distributed throughout Britain. It has been regularly recorded in London since 1950, mainly from areas on the outskirts, particularly in winter hibernation sites. Fitter (1949) had records from sites in and around central London including Blackfriars Bridge, The Serpentine, St James's Park, Regent's

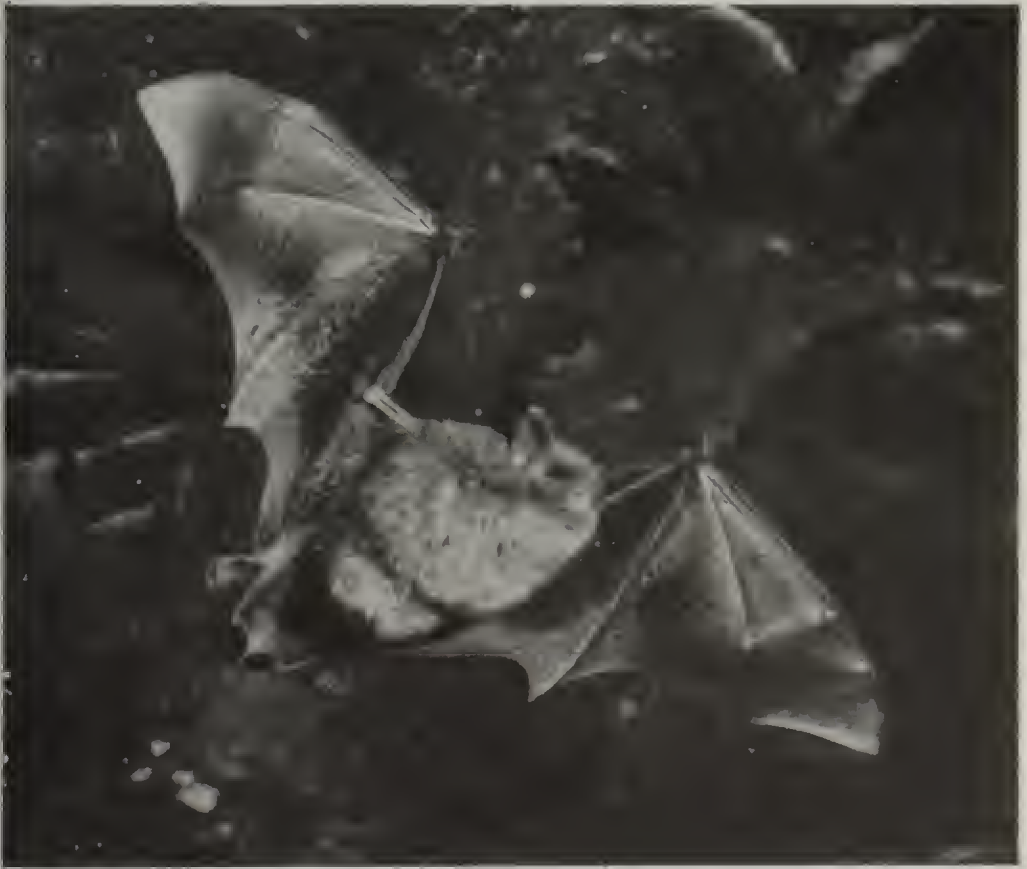


FIG. 3. DAUBENTON'S BAT *Myotis daubentonii.* This species has a very characteristic flight pattern of skimming a few centimetres above the surface of water and feeding on aquatic insects. *Photograph copyright Frank Greenaway.*

Canal, Putney, Hendon and Brent Reservoir. Earlier records include Grove Mill, Watford (Oldham 1907), Teddington 1904 (unpublished B.R.C.), Islington (Bell 1874), Hillingdon 1850 (B.R.C.) and Epping 1800 (B.R.C.). Gilbert White (1788), in a letter to Thomas Pennant dated 9 September 1767, mentions 'myriads of bats on the Thames between Richmond and Sunbury'. Barrett-Hamilton and Hinton (1910-21) assumed that these were Daubenton's bats, though it is likely that other species were also present.

Only two summer roosts have been found in recent times. One was a nursery colony numbering at least 170 in a house in Ickenham. This was sealed in 1977. The other was a nursery roost of at least 30 in a cave at Chipstead, Kent, which was present between 1979 and 1981. During the survey a small number of feeding records were obtained mainly from sites on the outskirts of London. Hampstead Heath can be considered the only Inner London record. Despite an extensive search along most of the Regent's Canal no Daubenton's were seen although they were recorded along the Grand Union Canal at Denham. The south-west area of London is a particularly good feeding area for this species, with records from Richmond Park, Bushey Park, the River Thames and Wimbledon Common. Daubenton's were also regularly found in winter sites, being recorded from 16 out of the 28 known sites in the L.N.H.S. area.

Other references:
Beames 1968, 1969, Bell 1837, Bucknill and Murray 1902, Burton 1966, 1974, Chapman and Hammond 1962, Clark 1979, Cocks 1905, Corke 1984, Dalgleish 1904*b*, 1908, Dobson 1985, 1986, Findon 1913, Fitter 1960, Fitter and Lousley 1953, Hancock 1964, Harting 1889*a*, Hooper 1970, 1977, 1981, Kelsall 1889, Laver 1898, 1903, Leutscher 1974, Livesley 1969, Lloyd 1947, Pickess 1955, 1956, Rigden 1955, Seear 1964, Skinner 1976, Stubbs 1917, Teagle 1964, 1965, Tinning 1963, Vesey-Fitzgerald 1949, Woodroffe and Southgate 1951.

PIPISTRELLE BAT *Pipistrellus pipistrellus*. Maps 11 and 19. (Fig. 4).

The pipistrelle occurs throughout Britain and is our commonest species. In his 16-year study, Hooper (1981) located pipistrelles at 192 of the 222 sites he visited. Prior to 1950, published records of pipistrelles are few, though this is not a sign of their scarcity. Fitter (1949) recorded that that they were common throughout the London area right into the heart of Inner London, with records from Chancery Lane, Oxford Street, Shoe Lane and from St Paul's Cathedral in 1926. There are many records of pipistrelles in the 19th Century, the earliest being Epping Forest 1841 (Doubleday 1843).

Pipistrelles were by far the most commonly recorded species in the survey. In the feeding survey they were found in 87% of sites where a positive identification of species was made. It is likely that a large proportion of bats given as 'unidentified' were also pipistrelles. The roost data also reflect their abundance. Positive species identification was made at 90 (66%) of the 137 new summer roosts reported in 1985-86 and, of these, 75 (83%) were pipistrelle. As with the feeding data it is likely that most of the remaining roosts were pipistrelles. All of the roosts were in buildings. Pipistrelles do roost in trees, but locating these is extremely difficult. The size of roost varied widely. In one roost in Wallington, which has been extensively studied over the past two years, the number has never exceeded 32. In contrast, some of the larger roosts have numbered several hundred. The largest roost, in a house in Roehampton, was of 500. Other large roosts include 415 in Twickenham, 400+ in Rickmansworth, 327 in West Drayton and 200 in Esher. These figures usually refer to single counts so it is quite likely that some roosts are bigger than stated. A roost of 180 pipistrelles in a block of flats in Swiss Cottage proved to be the closest to the centre of London. A newspaper cutting from 1977 shows that this roost has been in existence for a least 10 years. In 1977 its size was estimated at 2,000 bats, but the reliability of this figure is not known. In contrast to the summer roost and feeding data there is virtually no information about wintering pipistrelles. Apart from a few specimens

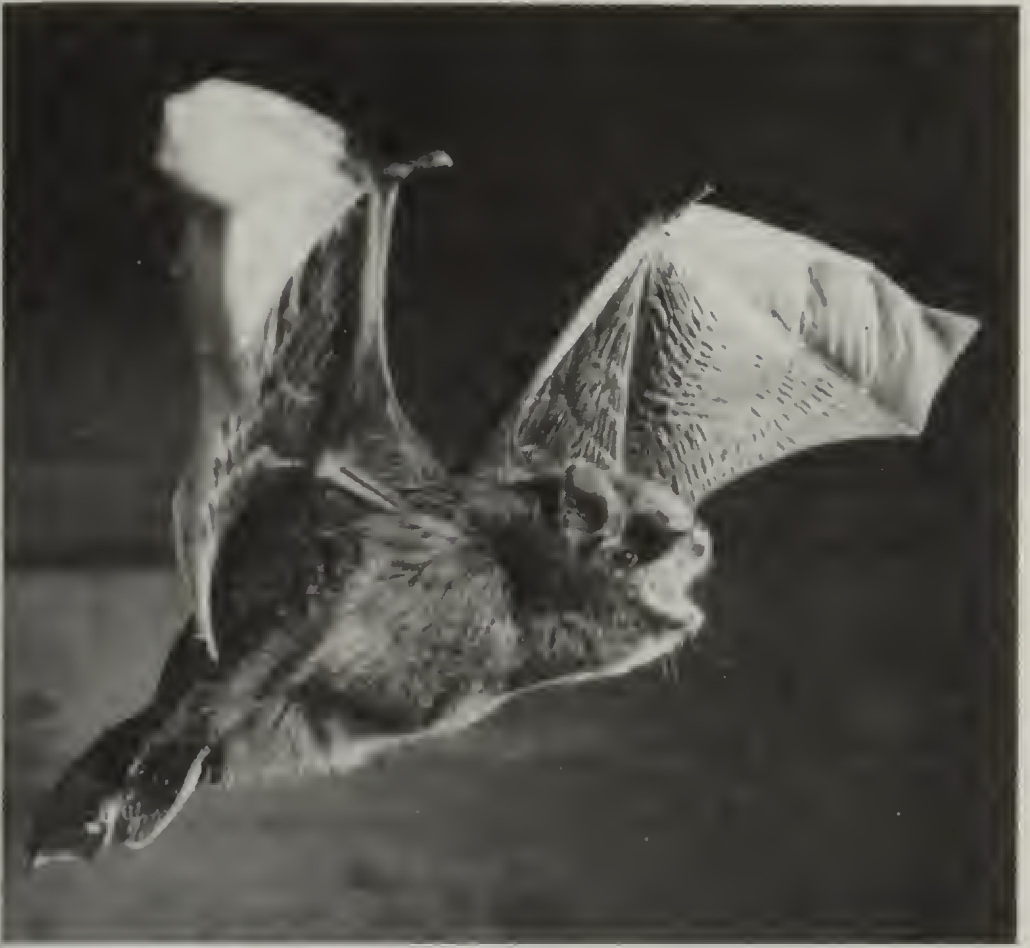


FIG. 4. PIPISTRELLE BAT *Pipistrellus pipistrellus.* Many British species, such as the pipistrelle, hold their mouths open during flight as they send out echo-location sounds. *Photograph copyright Frank Greenaway.*

found in winter we know of no hibernation sites. Pipistrelles often roost singly or in small groups and will frequently use buildings and trees where their presence would normally be impossible to determine. The types of sites checked in the winter (e.g. caves, mines and ice-houses) are not normally used by pipistrelles.

The overall abundance of pipistrelles is no surprise; they frequently roost in buildings, often modern ones, and there is no shortage of these in London. It is surprising, perhaps, that we have not found even more roosts, particularly in the central area. Many parks and gardens in Inner London are used by feeding pipistrelles so presumably these bats may roost close by.

Other references:
Anon. 1971, Baker 1908, Barrett-Hamilton and Hinton 1910-21, Banks *et al.* 1982, Beadell 1932, Beames 1968, 1969, Blakeley 1979, Brewer 1856, Bucknill and Murray 1902, Burton 1966, 1974, Chapman and Young 1979, Clark 1974, 1975, 1979, Cocks 1905, Collenette 1937, Collingwood 1859, Corbet 1984, Cotton 1979, Crossman 1902, DeVere 1909, Dobson 1984, 1985, 1986, Findon 1913, Fitter 1960, Fitter and Lousley 1953, Gold 1975, Grosvenor 1914, Hall 1923, Hall 1978, Hancock 1964, Hanson 1983, Hobson 1924, Hooper 1970, 1977, Huggins 1956, Jesse 1834-5, Laver 1898, 1903, Leutscher 1974, Livesley 1969, Martin 1986, Millais 1904-6, Morris *et al.* 1984, Nature Conservancy 1969, Paine 1971, Penrose *et al.* 1985, Pickess 1955, 1956, Punnett 1906, Rigden 1955, Sage 1966, Seear 1964, Sidcup and District Natural History Society 1951, Skinner 1976, Smalley 1911, Soames 1895, Stubbs 1917, Teagle 1964, 1965, Tinning 1963, Tutt 1909, Webb *et al.* 1899, Webster 1911, Wilmore *et al.* 1925.

NATHUSIUS'S PIPISTRELLE *Pipistrellus nathusii*.

An extremely rare bat; only three have been recorded in Britain. One was recorded in Hertfordshire in 1978 (Banks *et al*. 1983).

LEISLER'S BAT *Nyctalus leisleri*. Maps 12 and 14. (See Frontispiece).

A very rare bat confined to southern Britain and Ireland. Though there are rarely more than two or three records of Leisler's bats in Britain every year, historically the London area has provided a significant number of records. They have been recorded from Grays (Skinner 1976), Hyde Park 1973 (unpublished B.R.C.), Welwyn Garden City 1972 (Clark 1973), Kew Gardens 1969 (unpublished L.N.H.S.) and 1965 (Beames 1968), Walton-on-Thames 1964 (Beames 1968), Sevenoaks 1957 (Hancock 1964), Abbey Wood 1953 (Rigden 1955) and Chislehurst (Tutt 1909).

Three Leisler's specimens were found during the survey, two around Highgate Wood in 1986 and one in the grounds of Chiswick House, west London in 1985. Though noctule and Leisler's bats are not separated in the feeding survey data, it is likely that most seen were noctules. There have been several sightings of probable Leisler's bats at Richmond Park (F. Greenaway, *pers. comm.*), Wanstead Flats and Chiswick House.

Other references:
Burton 1966, 1974, Clark 1974, 1979, Dobson 1985, 1986, Livesley 1969, Seear 1964.

NOCTULE BAT *Nyctalus noctula*. Maps 13 and 14. (Fig. 5).

Found throughout Britain except for northern Scotland. There have been many historical records in the London area, particularly since 1960. Hooper (1981) recorded *Nyctalus* species (he did not distinguish between noctule and Leisler's bats) at 70 sites and he believed the majority of these to be noctules. Fitter (1949) reported them as being common throughout the London area, but could find no records from Kent since 1930, though they were common there prior to 1914. Nineteenth Century records include Garratt Park, Wandsworth 1899 (unpublished B.R.C.), Elstree Reservoirs 1895 (Lloyd 1947), Norbury near Leatherhead prior to 1890 (Bucknill and Murray 1902), Fulham Park 1887 (unpublished

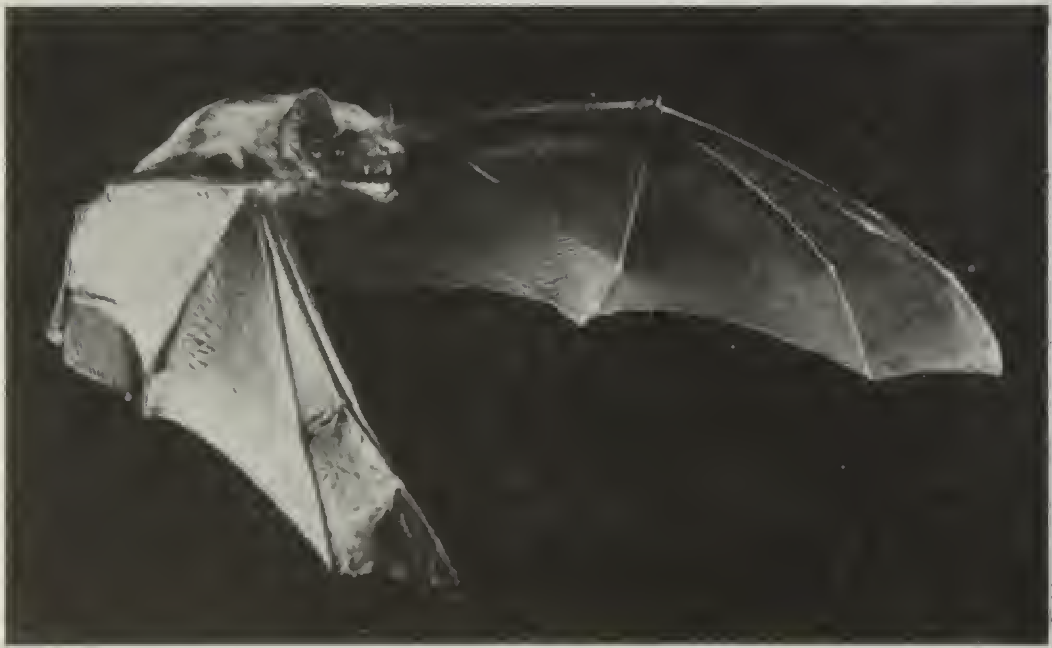


FIG. 5. NOCTULE BAT *Nyctalus noctula*. This large species has powerful jaws for feeding on large flying insects. *Photograph copyright Frank Greenaway.*

B.R.C.), Anerley Park 1875 (Norgate 1906), Kingsbury 1868 (unpublished B.R.C.) and Epping Forest 1841 (Doubleday 1843).

Noctules are almost exclusively tree dwelling and this makes roost-finding extremely difficult. During the 1985-86 survey only four roosts were located. It is believed that the roost in Walton-on-Thames may have contained up to 100 bats. A maximum of 28 bats were seen leaving the Highgate Wood roost. The other two remaining roosts contained fewer than five bats. It is almost certain that there were more roosts in the areas of Enfield, Hampstead Heath and Highgate Wood.

In the feeding survey *Nyctalus* species were recorded from almost half the sites where identification was made. It is believed that the majority of these were noctules. Some of the more important feeding sites include Hampstead Heath, Hyde Park, Berwick Pond, Osterley Park, Richmond Park and Bushey Park. Limited access prevented a thorough search, but the Lea Valley reservoirs also appeared to be important noctule feeding sites.

Other references:

Anon. 1971, Baker 1908, Barrett-Hamilton and Hinton 1910-21, Beadell 1932, Beames 1968, 1969, Bell 1837, 1874, Bingley 1809, Blakeley 1979, Brewer 1856, Burners 1977, Burton 1966, 1974, Chapman and Young 1979, Clark 1974, 1975, 1979, Cocks 1905, Cotton 1979, 1980, Criddle 1890, Crossman 1902, Dalgleish 1904*a*, Dobson 1984, 1985, 1986, Findon 1913, Gold 1975, Grosvenor 1914, Hancock 1964, Harting 1891, Hobson 1924, Hooper 1970, 1977, Huggins 1956, Jesse 1834-5, Laver 1898, 1903, Leutscher 1974, Livesley 1969, Martin 1986, Millais 1904-6, Morris *et al.* 1984, Nature Conservancy 1969, Paine 1971, Pickess 1955, 1956, 1957, Punnett 1906, Rigden 1955, Sage 1966, Seear 1964, Skinner 1976, Smalley 1911, Soames 1895, Stubbs 1917, Teagle 1965, Tutt 1909, Wilmore *et al.* 1925, Woodroffe and Southgate 1951.

NORTHERN BAT *Eptesicus nilssonii.* (See Frontispiece).

An unusual bat was seen at a winter site in north Surrey in 1986, but was left undisturbed. A similar looking individual was seen at the same site in 1987, and was examined and photographed. It was later identified as the first British record of northern bat (Greenaway and Hill 1987).

SEROTINE BAT *Eptesicus serotinus.* Maps 15 and 20.

A species found in southern Britain. Recent London area records have been mainly from the outskirts, including Oxted, Esher, Mickleham, Rye Meads, Bletchingley, Beddington and Godstone. Hooper (1981) recorded them only four times. Fitter (1949) reported them as occurring from Sevenoaks to Westerham and as close to the centre as Greenwich Park. He documented earlier records from Great Parndon, Loughton and Ongar in Essex in 1943, Welwyn, Hertfordshire in 1937, Richmond Park and Mill Hill in 1936, and Kenley in 1902. Barrett-Hamilton and Hinton (1910-21), recorded serotines at Pitsea near Tilbury in 1906 and Dartford Heath 1891. They are also recorded as occurring in London by Lydekker (1895) and Macgillivray (1838).

During the survey four serotine roosts were reported from Greater London and Surrey. In all 21 roosts have been reported from the L.N.H.S. area in recent years. Only three feeding sites were located during the survey, Berwick Pond, Beddington Park and Winey Hill, Chessington. Three dead or injured serotines were also found; two in Elm Park in 1986 and one in Hornchurch in 1985.

Other references:

Baker 1908, Beames 1968, 1969, Bell 1837, 1874, Burton 1966, 1974, Clark 1974, 1975, 1979, Cocks 1905, Collingwood 1859, Dobson 1984, 1985, 1986, Fitter 1950, Gray 1825, Hancock 1964, Harting 1891, Hooper 1970, 1977, Huggins 1956, Laver 1903, Livesley 1969, Millais 1904-6, Pickess 1955, Rigden 1955, Seear 1964, Skinner 1976, Smalley 1911, Stubbs 1917, Teagle 1964, Tutt 1909, Vesey-Fitzgerald 1949, Wilmore *et al.* 1925.

BARBASTELLE BAT *Barbastella barbastellus*. Map 16.

This is a rare species, which probably occurs throughout England and Wales. The last record for the London area was Painshill, Surrey in 1968. Prior to that it had been recorded from Cobham 1965 and Juniper Hall 1962 (Beames 1968), Sidcup 1952 (Fitter 1960), Richmond Park 1946 and Acton 1939 (Beames 1968) and Dartford prior to 1909 (Tutt 1909). There are also a number of 19th Century records including Hornsey 1874 (Borrer 1874), Epping 1843 (Seear 1964) and Sowerby's first British specimen taken at Dartford by Peete in the early 1800s (Barrett-Hamilton and Hinton 1910-21). Chislehurst Caves figured as an important site at this time with records in 1837, 1859 and 1874. This is interesting considering it is now probably not used at all by bats due to disturbance.

Other references:
Baker 1908, Bell 1837, 1874, Bingley 1809, Bucknill and Murray 1902, Cocks 1905, Collingwood 1859, Doubleday 1843, Fitter 1949, 1950, Laver 1898, 1903, Livesley 1969, Millais 1904-6, Mitford 1860, Oldham 1908, Sidcup and District Natural History Society 1951, Stubbs 1917, Webb *et al.* 1899, Wilmore *et al.* 1925.

BROWN LONG-EARED BAT *Plecotus auritus*. Maps 17 and 21. (Fig. 6).

Considered to be the second commonest species in Britain. Since 1950 most of the London area records have been from the outskirts, mainly from winter hibernation sites. Fitter (1949) commented that before 1914 long-eared bats were common throughout the area, but since then they were local but plentiful. He had

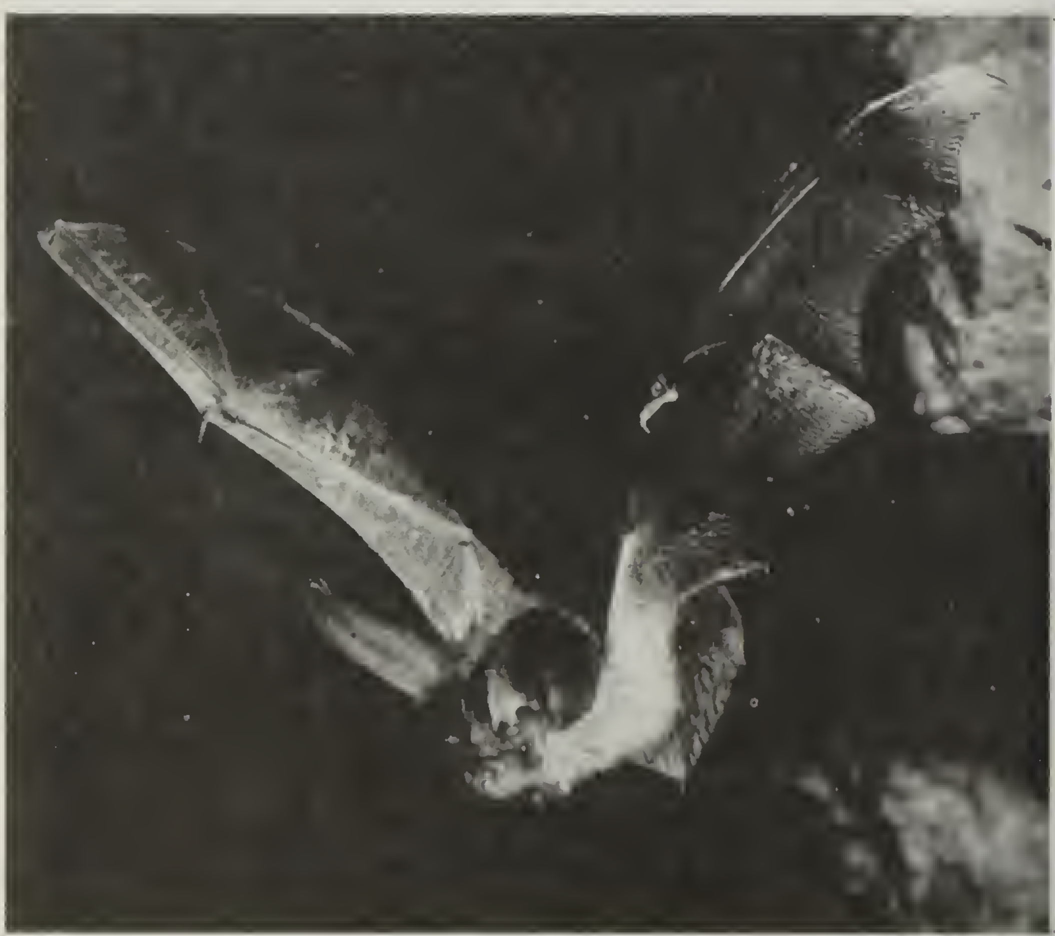


FIG. 6. BROWN LONG-EARED BAT *Plecotus auritus*. In this species the ears are almost as long as the body. It feeds by gleaning insects from vegetation.

Photograph copyright Frank Greenaway.

records from Regent's Park in 1904, 1911 and 1925, St James's Park 1904 and Greenwich Park 1902. Also between 1920 and 1948 they had been recorded from six sites in Surrey, one in Middlesex, one in Hertfordshire and two in Essex. Tutt (1909) lists records from Hayes 1895, Lewisham 1909 and Beckenham 1903. Seear (1964) recorded them as very common at Epping in 1898. Finally there are individual records from South Kensington 1897, Hoddesdon 1895, Chislehurst 1837, 1859 and 1874 (unpublished B.R.C.), Reigate (Brewer 1856) and Epping Forest 1841 (Doubleday 1843).

Despite being a common species there have been few records during the survey. Only two roosts were discovered within the G.L.C. area, though more were found in Surrey and Kent. A single long-eared specimen was found in Harrow in 1986. No positive identifications at feeding sites were received during the survey. They were found regularly at winter sites, being recorded at 76% of known sites, but numbers at these sites were small. The general paucity of information is not altogether surprising. Long-eareds frequently feed amongst foliage making them difficult to see, and their echolocation sounds are barely audible on bat detectors. The small number of summer roosts is surprising, since they are a very common source of enquiry in surrounding counties, though their small numbers and secretive habits may make them less obvious than other species such as pipistrelles.

Other references:

Baker 1908, Barret-Hamilton and Hinton 1910-21, Beadell 1932, Beames 1968, 1969, Bell 1837, 1874, Beven 1980, Bucknill and Murray 1902, Burton 1966, 1974, Chapman and Hammond 1962, Clark 1973, 1974, 1979, Cocks 1905, Collingwood 1859, Corke 1984, Cotton 1979, 1980, Crossman 1902, Dobson 1985, 1986, Findon 1913, Fitter 1960, Gold 1975, Gray 1825, Hancock 1964, Hobson 1924, Huggins 1956, Laver 1898, 1903, Livesley 1969, Lloyd 1947, Millais 1904-6, Nature Conservancy 1969, Pickess 1955, Rigden 1955, Skinner 1976, Soames 1895, Stubbs 1917, Teagle 1964, 1965, Webb *et al.* 1899, Webster 1901, 1911, Wilmore *et al.* 1925, Woodroffe and Southgate 1951.

UNIDENTIFIED BATS.

The following is a list of references where bats are mentioned but no species identification is made:

Belfrage 1860, Clark 1974, 1979, Corbet 1982, 1984, Corke 1979, Douglas 1843, Fitter 1945, Gold 1975, 1976, Hodgson 1954, Holdsworth 1859, Johnson 1910, 1912, Lambert 1843, Martin 1902, Paine 1968, 1969, 1970, Pickess 1958, 1960, 1963, 1965, Smee 1872, Teagle 1965, Trapp 1845, Tucker 1946.

Conclusions

The survey results emphasize the abundance of pipistrelles in the London area and this reinforces the views of previous studies (e.g. Hooper 1981 and Martin 1986). At the feeding sites *Nyctalus* species were the second commonest bats. Most of these were thought to be noctules and the results show there are still many suitable roost sites for these species (though the survey only located four of them). Other species were rarely recorded at summer sites and feeding areas. Although bats can be found all over the capital, London has a low species diversity. Greater horseshoe, lesser horseshoe and barbastelle bats are no longer found regularly in the London area and even species such as Daubenton's are now regularly found only in the outer suburbs. There are also now few areas where large numbers of bats feed. It seems unlikely that pipistrelles could ever become endangered in London for want of potential roost sites, but loss of feeding areas could be a serious threat. Tree-roosting species are threatened by management practices that remove dead and dying trees, and with them, potential roosts. It is hoped that the provision of bat boxes will help replace some of the lost sites. Several large schemes are already under way; 300 boxes have been erected in Camden, over 80 in Barnet and over 60 in Brent. Pressure from development threatens all species.

The situation in the winter sites is worrying. Only five sites are known within the G.L.C. area and all are used by small numbers of bats, though the whereabouts of the commonest summer species, the pipistrelle and the noctule, remains unknown. In the L.N.H.S. area as a whole 28 sites are known. Many of these are threatened with disturbance and development and need protection. Some of the more important sites are already grilled or are to be grilled in the future and this work must continue. The search for new sites must also continue. This study has shown the importance of the many sites which are home to only a few bats. The construction of artificial bat hibernacula as in Brent in London (McClauchlin *et al.* 1986) and Monkton in Kent (Hutson 1986) may provide part of the answer to the problem. Better still would be to improve existing sites to make them available to bats or to re-open sites such as has been done by caving groups at the extensive underground workings around Merstham in Surrey (Sowan 1986).

Distribution Maps

NOTES

Maps 4 to 17.

Distribution maps are presented for all species except Nathusius's pipistrelle and northern bat, since there has only been one record for each of these species:

Nathusius's pipistrelle:	Wormleybury near Cheshunt, Herts 1978 Grid ref: TL 3 0 tetrad T44
Northern bat:	Betchworth, Surrey 1987 Grid ref: TQ 3 5 tetrad T00

The maps were compiled using the results of this survey and historical information. Many of the older records have had to be assigned a grid reference based on the locality name given. Where an older record is superseded by a more recent one only the most recent is shown.

KEY:

Symbol	Date of record
●	1960-86
⊗	1950-86 (Kent only)
○	1900-59
×	pre 1900

Maps 18 to 21.

For the commoner species an additional map is given showing how the most recent records were obtained (see 'Identification and Acceptability of Records')

KEY:

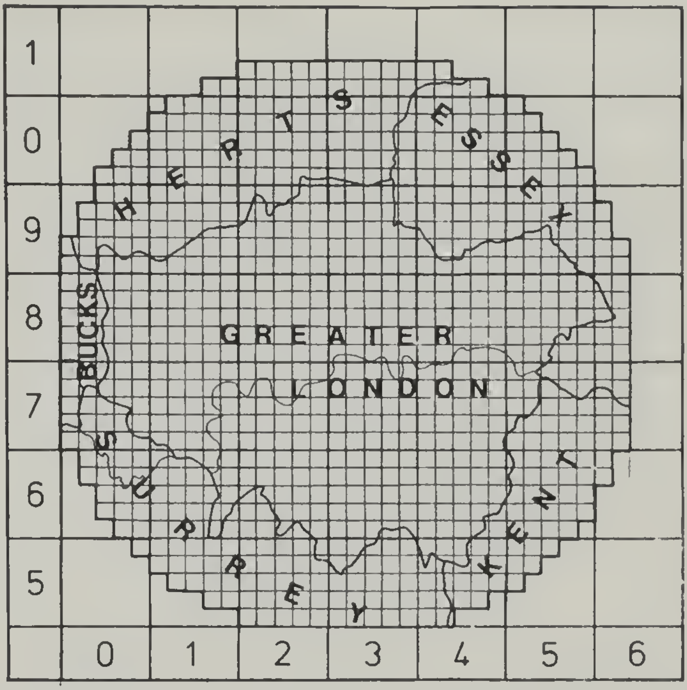
Symbol	Type of record
●	Specimen
○	Roost
×	Bat Detector and flight

Map 22

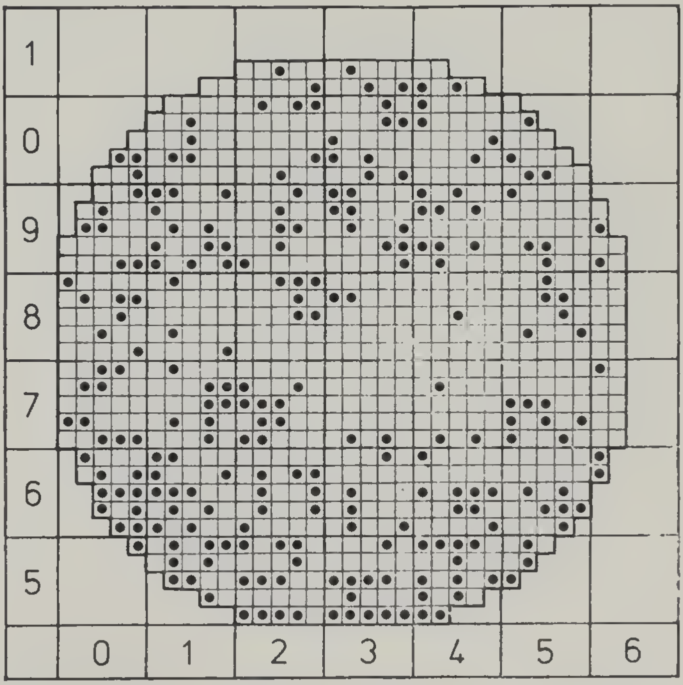
Shows the distribution of all bat records 1960-86. All flight records of bats are included on the map.

KEY:

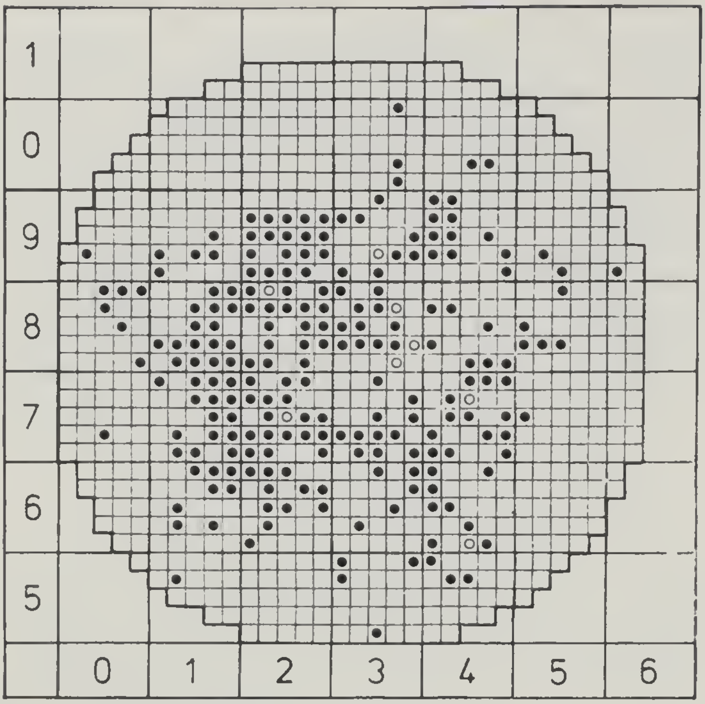
●	Site visited and bats found
○	Site visited and no bats found



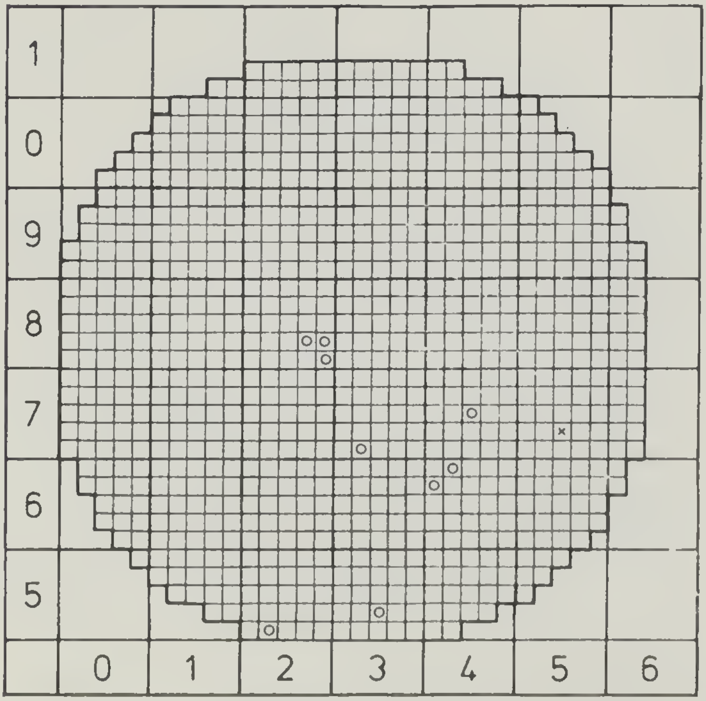
MAP 1. Base map showing the boundaries of the Greater London Council area and surrounding counties.



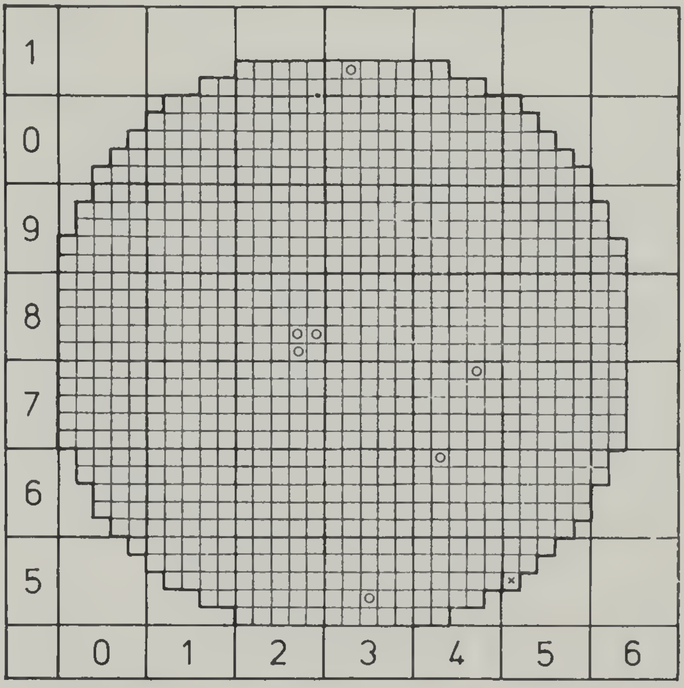
MAP 2. Distribution of summer roosts of bats 1950-86.



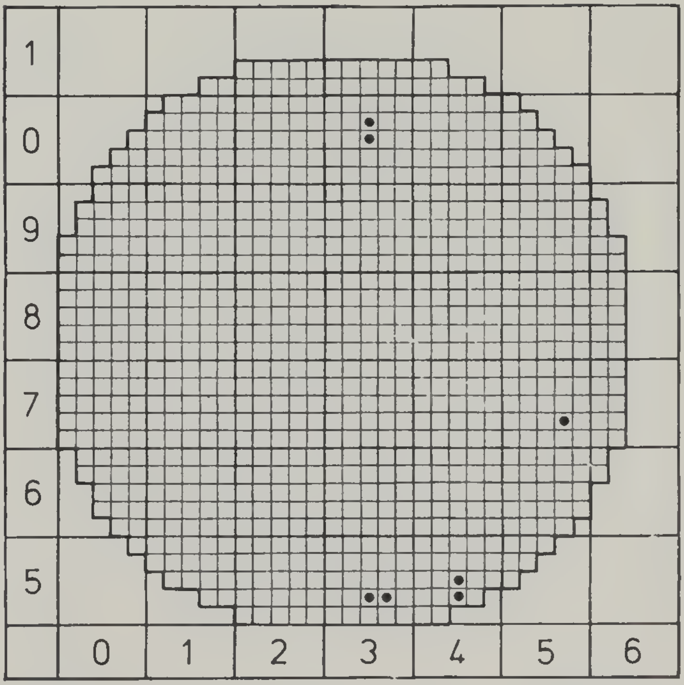
Map 3. Feeding sites visited 1985-86.



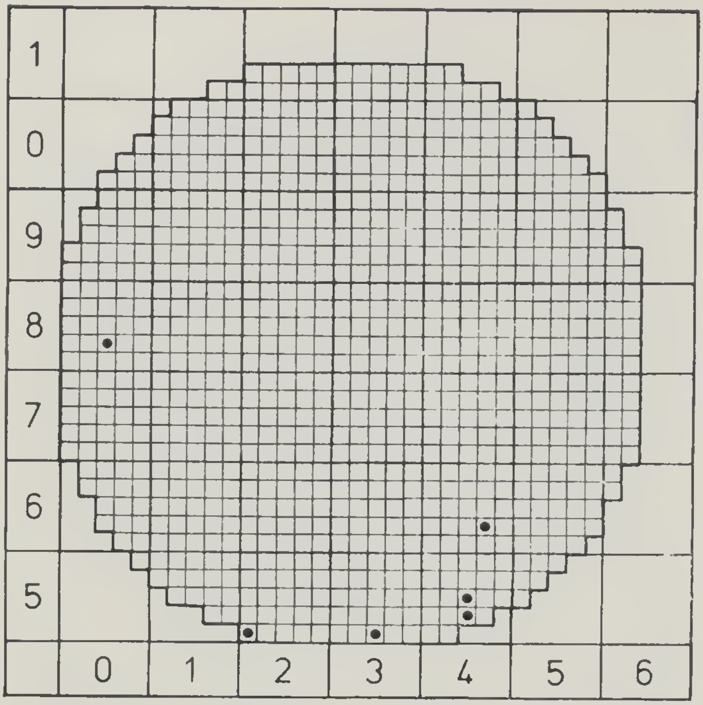
Map 4. Greater horseshoe bat *Rhinolophus ferrumequinum*. Recorded distribution.



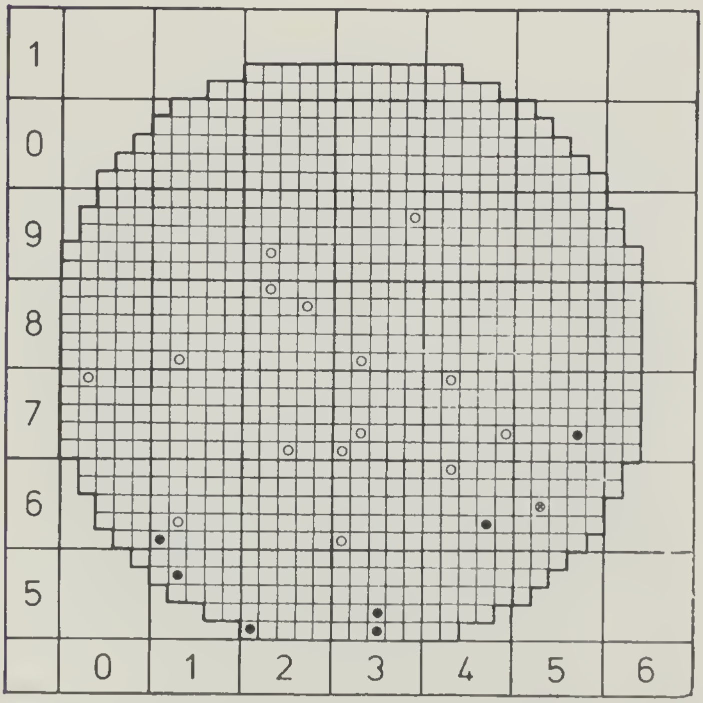
MAP 5. LESSER HORSESHOE BAT *Rhinolophus hipposideros*. Recorded distribution.



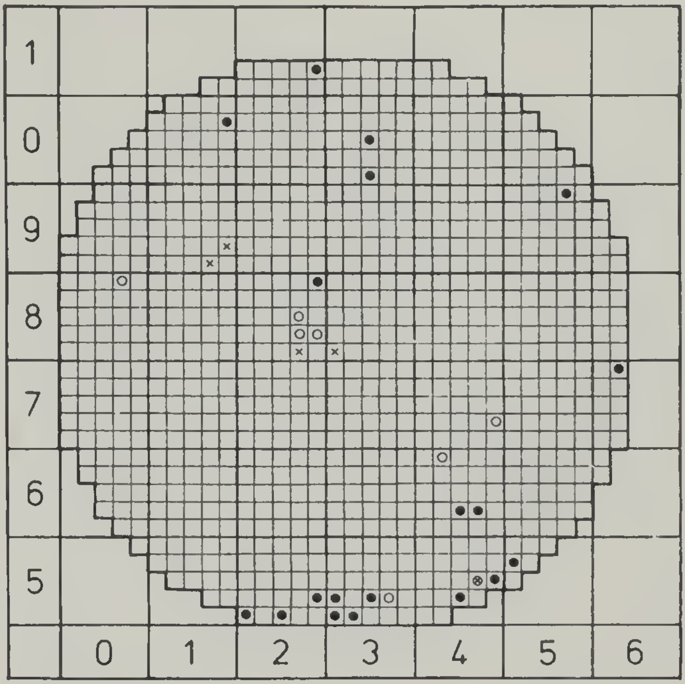
MAP 6. WHISKERED BAT *Myotis mystacinus*. Recorded distribution. Only positively identified post-1971 records are shown.



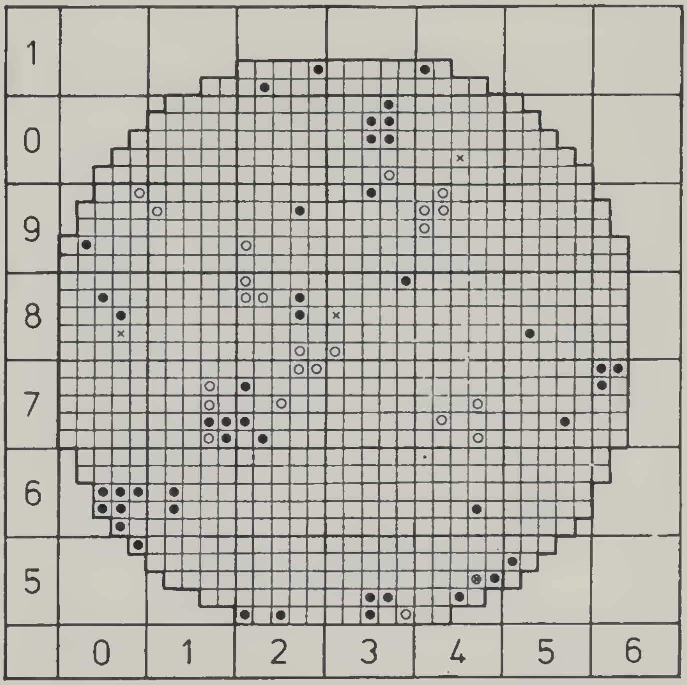
MAP 7. BRANDT'S BAT *Myotis brandtii.* Recorded distribution.



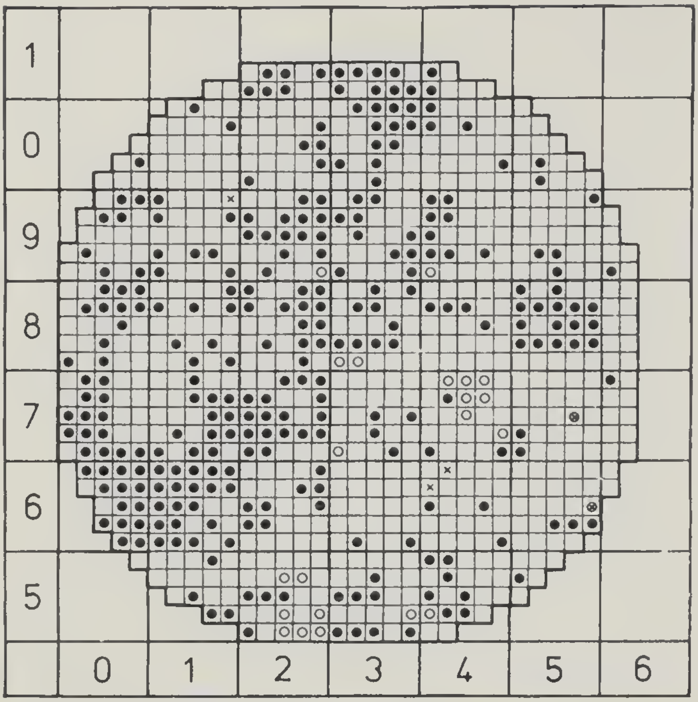
MAP 8. WHISKERED/BRANDT'S BAT *Myotis mystacinus/M. brandtii.* Recorded distribution. Includes all post-1971 records where no separation of species was made and all pre-1971 'whiskered bat' records.



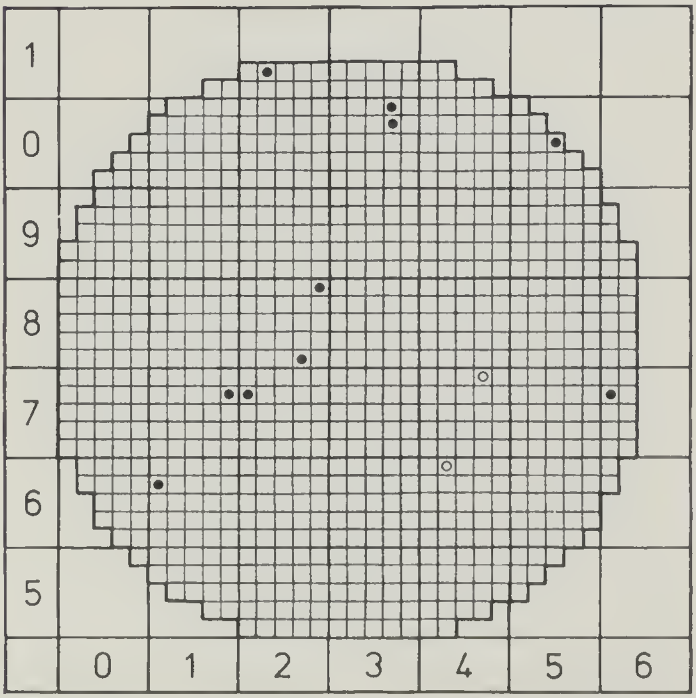
Map 9. Natterer's bat *Myotis nattereri*. Recorded distribution.



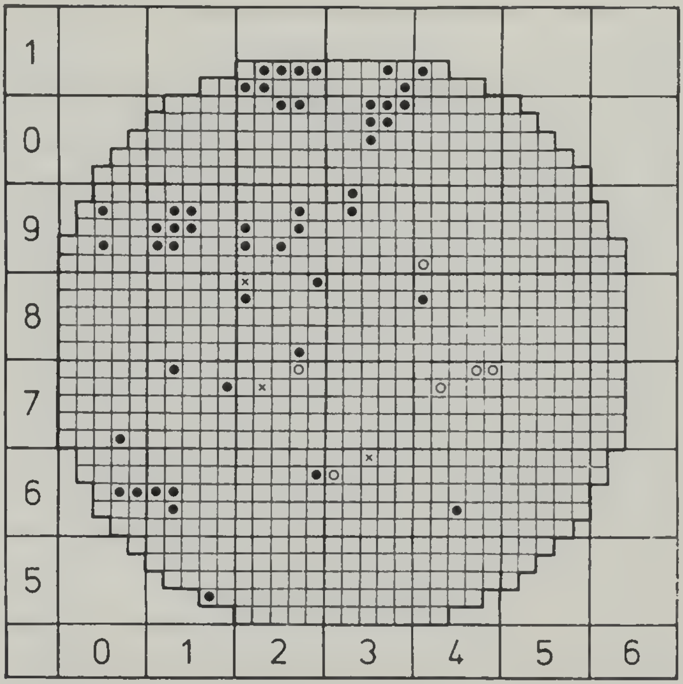
Map 10. Daubenton's bat *Myotis daubentonii*. Recorded distribution.



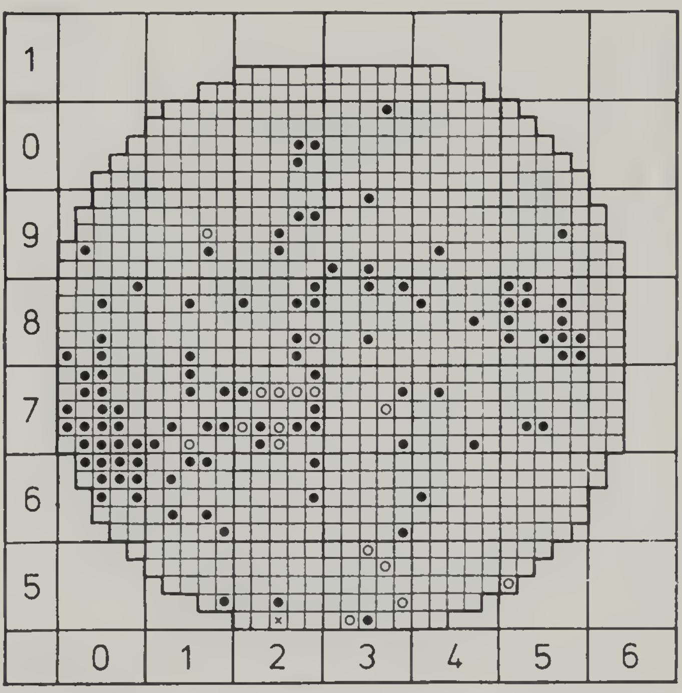
Map 11. Pipistrelle bat *Pipistrellus pipistrellus.* Recorded distribution.



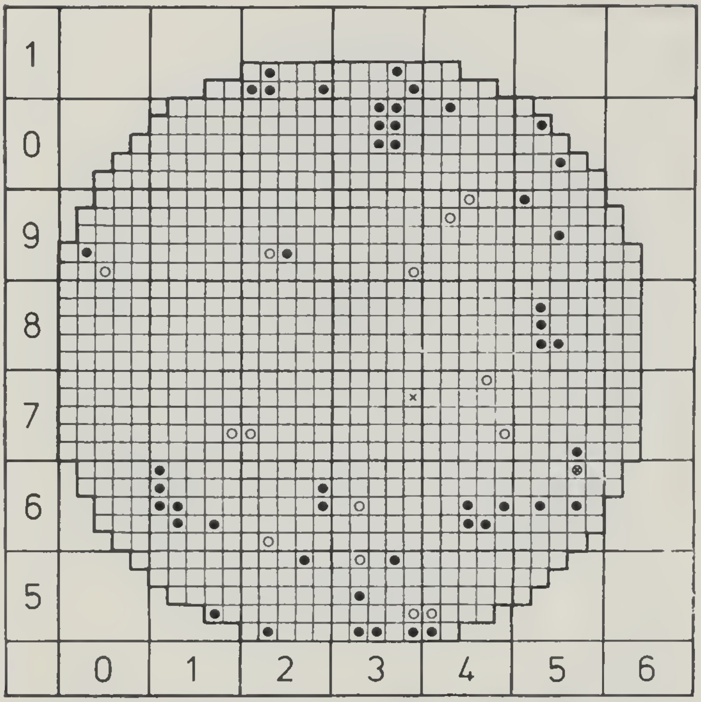
Map 12. Leisler's bat *Nyctalus leisleri.* Recorded distribution.



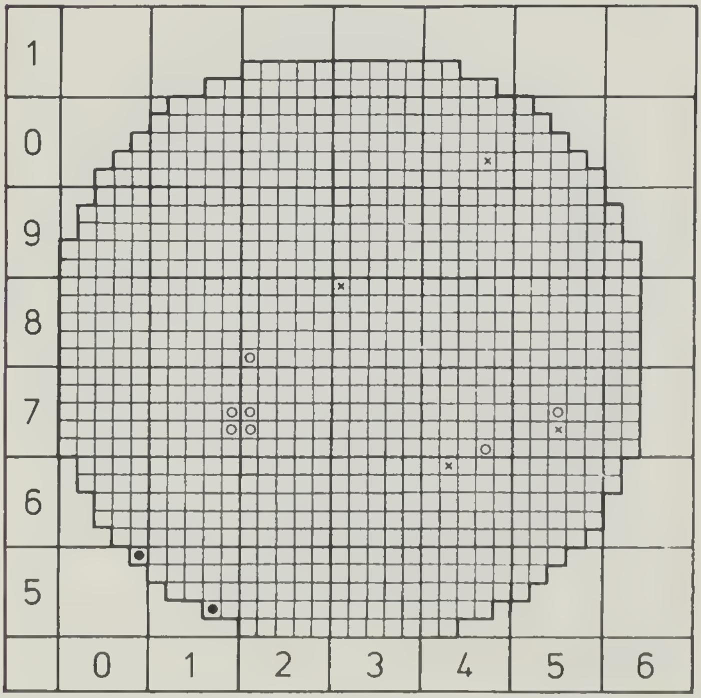
Map 13. Noctule bat *Nyctalus noctula*. Recorded distribution.



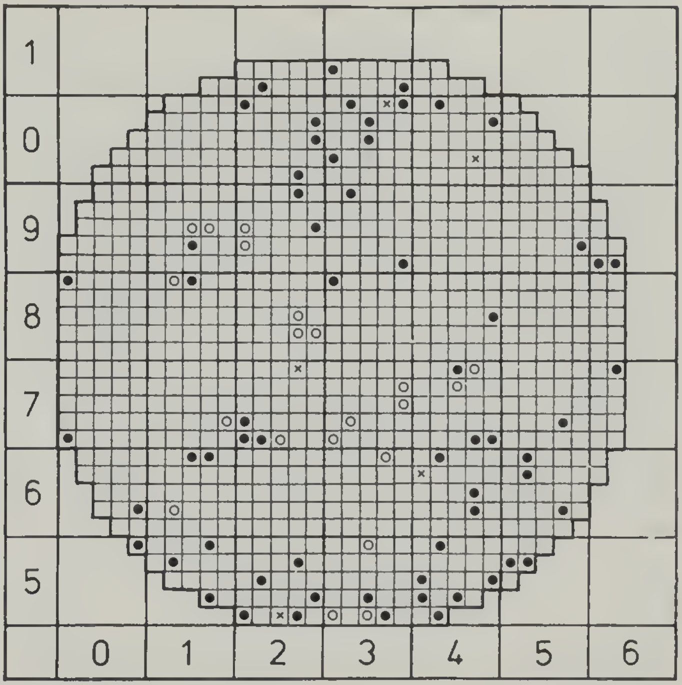
Map 14. *Nyctalus* spp. *N. leisleri*/*N. noctula*. Recorded distribution. Records include those made using bat detectors.



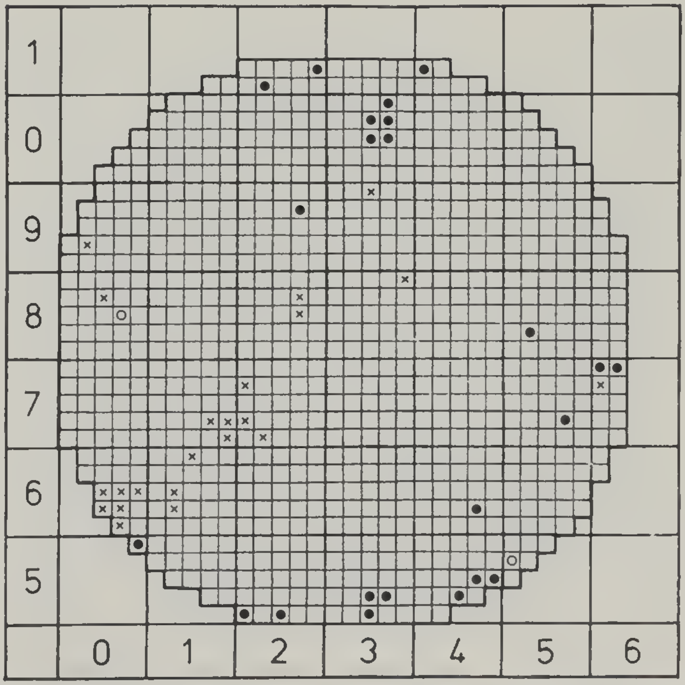
Map 15. Serotine bat *Eptesicus serotinus*. Recorded distribution.



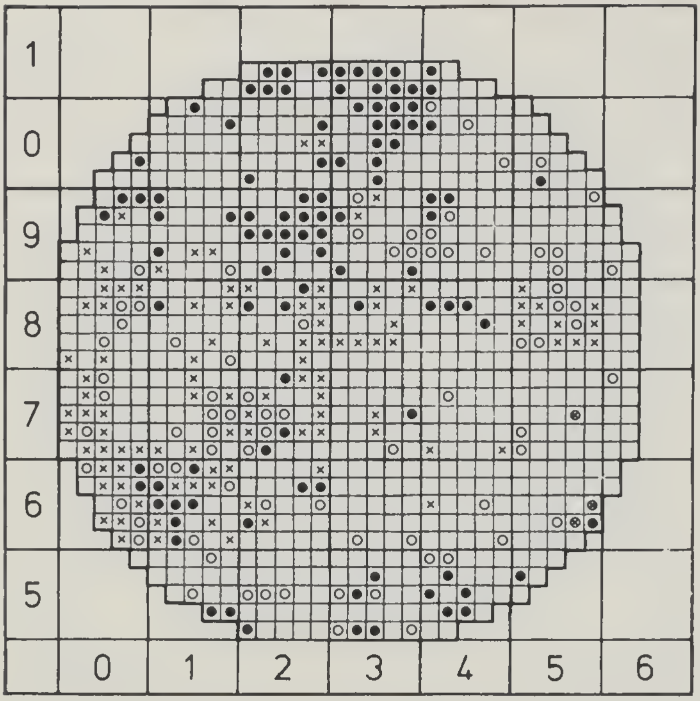
Map 16. Barbastelle bat *Barbastella barbastellus*. Recorded distribution.



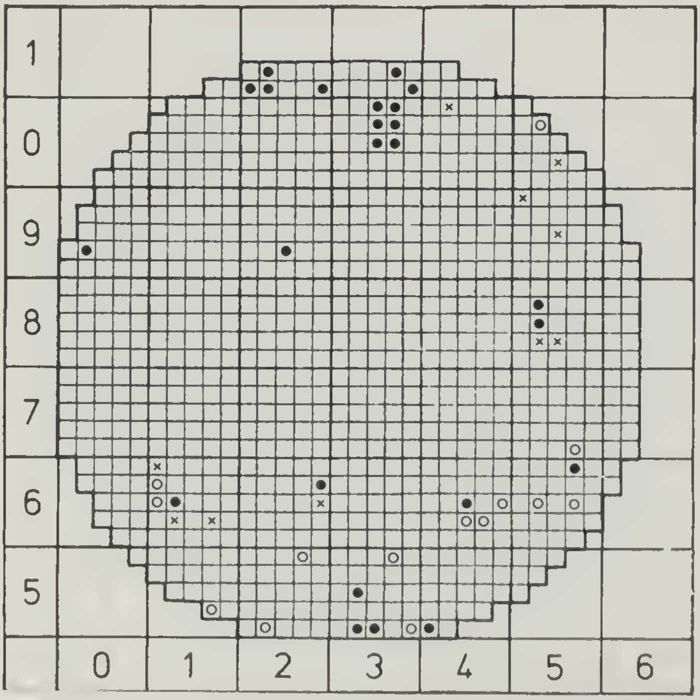
Map 17. Brown long-eared bat *Plecotus auritus*. Recorded distribution.



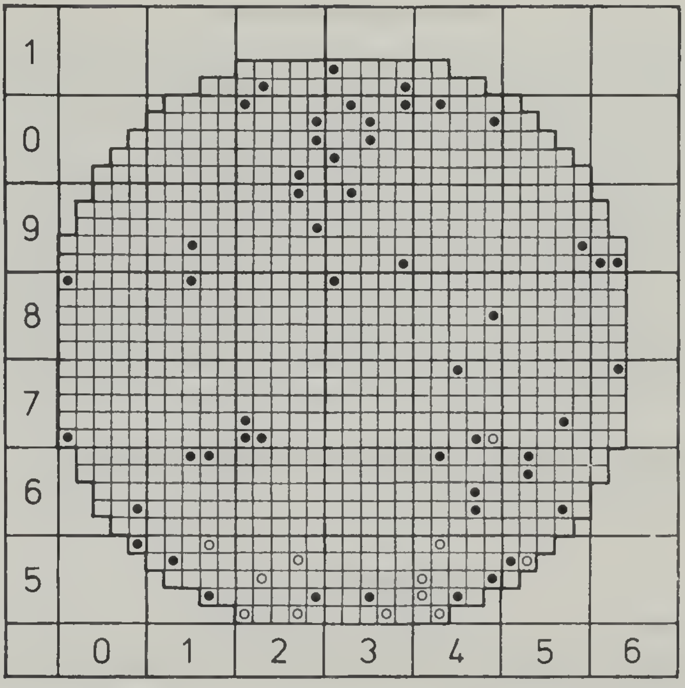
Map 18. Daubenton's bat *Myotis daubentonii*. Recorded distribution 1960-86 showing source of records.



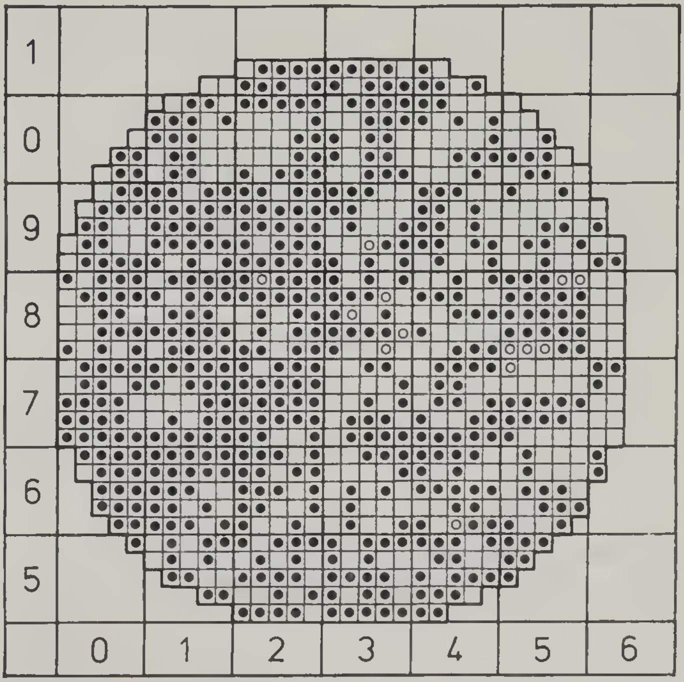
Map 19. Pipistrelle bat *Pipistrellus pipistrellus*. Recorded distribution 1960-86 showing source of records.



Map 20. Serotine bat *Eptesicus serotinus*. Recorded distribution 1960-86 showing source of records.



MAP 21. BROWN LONG-EARED BAT *Plecotus auritus*. Recorded distribution 1960-86 showing source of records.



MAP 22. All bat records 1960-86.

Acknowledgements

I would like to thank all the organisations who helped fund the London Bat Project: Greater London Council, London Natural History Society, London Boroughs Grant Scheme, and the Fauna and Flora Preservation Society. Thanks also to those who have supervised the project; Tony Hutson, Dave Dawson and Colin Plant.

Appendix 3 lists all the contributors to the feeding survey; without their help the work would not have been as successful as it was. I would like to thank Paul Sowan, Chris Bayley and other members of Unit 2 Caving Group for their help in visits to winter sites in Surrey, also Tony Hutson, Frank Greenaway and John Dobson for help with other winter visits.

A long time was spent searching for historical records and I thank all those who helped in this search; Tony Mitchell-Jones, Bob Stebbings, Henry Arnold, Tony Hutson, Frank Greenaway, Louise Clarke, Mike Waite, John Dobson, Michael Clark, Colin Plant and Paul Sowan. Thanks to Cindy Hartley for help with computing, to Dawn Thornton for help with the preparation of the maps and to Tony Hutson for general advice in the preparation of this paper.

Finally I would like to thank all at Fauna and Flora Preservation Society, especially Joan Tait and Tony Hutson, for their help and advice throughout the project.

References

ANON. 1971. Mammal Report. *J. Hillingdon nat. Hist. Soc.* **1**: 8-15.

BAKER, F. J. 1908. Mammals. Pp. 302-306. In: PAGE, W. (Ed.) *Victoria County History of Kent* **1**. Westminster, London.

BANKS, C., CLARK, M. and NEWTON, R. 1980. Observations on an unusual roost of serotine and noctule bats in east Hertfordshire. *Trans. Herts. nat. Hist. Soc.* **28** (3): 20-22.

BANKS, C., CLARK, M. and NEWTON, R. 1982. Summer roosts of pipistrelle bats in Hertfordshire. *Trans. Herts. nat. Hist. Soc.* **28** (6): 59-62.

BANKS, C., CLARK, M. and NEWTON, R. 1983. A second Nathusius's pipistrelle *(Pipistrellus nathusii)* in Britain, caught in flight in Hertfordshire. *Trans. Herts. nat. Hist. Soc.* **29** (1): 15-18.

BARRETT-HAMILTON, G. E. H. 1906. British distribution of the whiskered bat *(Myotis mystacinus). Zoologist.* **10** (series 4): 349.

BARRETT-HAMILTON, G. E. H. and HINTON, M. A. C. 1910-21. *A History of British Mammals.* Gurney and Jackson, London.

BEADELL, A. 1932. *Nature notes of Warlingham and Chelsham.* Croydon Advertiser, Croydon.

BEAMES, I. R. 1968. Bats in the London area. *Lond. Nat.* **47**: 38-49.

BEAMES, I. R. 1969. Mammals in the London area 1967. *Lond. Nat.* **48**: 40-47.

BELFRAGE, J. H. 1860. A bat flying in sunshine. *Zoologist* **17** (s. 1): 7102.

BELL, T. 1837. *A History of British Quadrupeds Including The Cetacea.* John Van Voorst, London.

BELL, T. 1874. *A History of British Quadrupeds Including The Cetacea.* 2nd Edition. John Van Voorst, London.

BEVEN, G. 1980. Survey of Bookham Common; thirty-eighth year. *Lond. Nat.* **59**: 60-65.

BINGLEY, REV. W. 1809. *Memoirs of British Quadrupeds Illustrative Principally of Their Habits of Life, Instincts, Sagacity and Uses to Mankind, Arranged According to The System of Linnaeus.* London.

BLAKELEY, A. 1979. Mammal report. *J. Ruislip Distr. nat. Hist. Soc.* **22**: 30-32.

BORRER, W. 1874. Notes on British bats. *Zoologist* **9** (s. 2): 4125.

BREWER, A. 1856. *A New Flora of The Neighbourhood of Reigate, Surrey.* William Pamplin, London.

BUCKNILL, J. A. and MURRAY, H. W. 1902. Mammals. Pp. 219-226. In: MALDEN, H. E. (Ed.) *Victoria County History of Surrey* **1**. Westminster, London.

BURNERS, G. 1977. Mammal Report. *Ann. Rep. Orpington Fld Club* **17**: 18-19.

BURTON, J. A. 1966. Notes on mammals of the London area during 1963 and 1964. *Lond. Nat.* **45:** 29-34.

BURTON, J. A. 1967. Notes on mammals in the London area for 1965. *Lond. Nat.* **46:** 40-43.

BURTON, J. A. 1974. *The Naturalist in London.* David and Charles, Newton Abbot.

CHAPMAN, D. I. and HAMMOND, P. M. 1962. A preliminary report on investigations in the deneholes at Hangman's Wood, Grays, Essex. *Essex Nat.* **31:** 1-15.

CHAPMAN, G. and YOUNG, B. 1979. *Box Hill.* Serendip, Lyme Regis.

CLARK, M. 1973. The survey of mammals, reptiles and amphibia in Hertfordshire. *Trans. Herts. nat. Hist. Soc.* **27** (5): 237.

CLARK, M. 1974. The survey of mammals, reptiles and amphibia in Hertfordshire: 1967-1973, progress report and maps. *Trans. Herts. nat. Hist. Soc.* **27** (6): 265-270.

CLARK, M. 1975. The survey of mammals, reptiles and amphibia in Hertfordshire: additional records. *Trans. Herts. nat. Hist. Soc.* **27** (7): 325-330.

CLARK, M. 1979. The survey of mammals, reptiles and amphibia in Hertfordshire. *Trans. Herts. nat. Hist. Soc.* **28** (2): 9-16.

COCKS, A. H. 1905. Mammals. Pp. 153-176. In: PAGE, W. (Ed.) *Victoria County History of Buckinghamshire* **1.** Westminster, London.

COLLENETTE, C. L. 1937. *A History of Richmond Park with an Account of Its Birds and Animals.* Sidgwick and Jackson, London.

COLLINGWOOD, C. 1859. *The Fauna of Blackheath and Its Vicinity. Part I, Vertebrate Animals.* Greenwich Natural History Club, London.

CORBET, G. B. 1978. *Mammals of the Palaearctic Region. A Taxonomic Review.* British Museum (Natural History). Cornell University Press, London and Ithaca.

CORBET, G. B. 1982. Mammal report for 1981. *Ann. Rep. Orpington Fld Club* **22:** 20-21.

CORBET, G. B. 1983. Mammal report for 1982. *Ann. Rep. Orpington Fld Club* **23:** 24-25.

CORBET, G. B. 1984. Mammal report for 1983. *Ann. Rep. Orpington Fld Club* **24:** 22.

CORBET, G. B. and SOUTHERN, H. N. (Eds.) 1977. *The Handbook of British Mammals* 2nd Edition. Blackwell Scientific Publications, Oxford.

CORKE, D. 1979. The mammals of Epping Forest. *Essex Nat.* **4** (N.S.): 15-24.

CORKE, D. 1984. *The Nature of Essex. The Wildlife and Ecology of The County.* Barracuda Books, Buckingham.

COTTON, J. 1979. Mammals in the London area 1978. *Lond. Nat.* **58:** 71-73.

COTTON, J. 1980. Mammals in the London area 1979. *Lond. Nat.* **59:** 84-86.

CRIDDLE, C. 1908. Kestrel chasing and killing a bat. *Zoologist* **14** (s. 3): 107.

CROSSMAN, A. F. 1902. Mammals. Pp. 217-222. In: MALDEN, H. E. (Ed.) *Victoria County History of Hertford* **1.** Westminster, London.

DALGLEISH, G. 1904*a*. Notes on the noctule *(Pterygistes noctula)*. *Zoologist* **8** (s. 4): 311.

DALGLEISH, G. 1904*b*. Daubenton's bat *(Myotis daubentonii)* in Middlesex. *Zoologist* **8** (s. 4): 345.

DALGLEISH, G. 1908. The mammals of Surrey. *Zoologist* **12** (s. 4): 178-184.

DEVERE, C. 1909. *Handbook of Richmond Park.*

DOBSON, J. 1984. *Essex Bat Group Report 1984.*

DOBSON, J. 1985. *Essex Bat Group Report 1985.*

DOBSON, J. 1986. *Essex Bat Group Report 1986.*

DOUBLEDAY, H. 1843. Notes on the occurrence of bats at Epping. *Zoologist* **1** (s. 1): 6.

DOUGLAS, D. W. 1843. Notice of a bat flying by daylight. *Zoologist* **1** (s. 1): 6-7.

FINDON, H. 1913. Mammals and reptiles. Pp. 207-240. In: *Hampstead Heath – Its Geology and Natural History.* Hampstead Scientific Society. T. Fisher Unwin, London.

FITTER, R. S. R. 1945. *London's Natural History.* Collins, London.

FITTER, R. S. R. 1948. Contributions to the bibliography of the natural history of the London area. *Lond. Nat.* **27:** 76-78.

FITTER, R. S. R. 1949. A check-list of mammals, reptiles and amphibia of the London area 1900-1949. *Lond. Nat.* **28:** 98-115.

FITTER, R. S. R. 1950. Some additional records of the mammals, reptiles and amphibia of the London area. *Lond. Nat.* **29:** 134-136.

FITTER, R. S. R. 1960. Further records of mammals, reptiles and amphibia in the London area. *Lond. Nat.* **39:** 18-21.

FITTER, R. S. R. and LOUSLEY, J. E. 1952. *The Natural History of the City.* Corporation of London.

FRAZER, J. F. D. 1965. Recent mammals in Kent. *Trans. Kent Fld Club.* **3:** 3-10.

GOLD, K. A. J. 1975. Mammals in the London area 1974. *Lond. Nat.* **54:** 66-68.

GOLD, K. A. J. 1976. Mammals in the London area 1975. *Lond. Nat.* **55:** 58-61.

GRAY, J. E. 1825. A list of species of Vespertilionidae found in Great Britain. *Zool. J. Lond.* **ii:** 108-110.

GREENAWAY, F. and HILL, J. E. 1987. A British record of the northern bat *(Eptesicus nilssonii). Bat News* **10:** 1-2.

GROSVENOR, T. H. C. 1914. Natural history of Colley Hill. *Proc. Holmesdale nat. Hist. Club 1910-1913:* 33-40.

HADFIELD, H. 1857. Reddish-grey bat *(Vespertilio Nattererii). Zoologist* **15** (s. 1): 5664.

HALL, D. G. 1978. Mammals in the London area 1976. *Lond. Nat.* **57:** 92-95.

HALL, H. R. 1923. *Round the Year in Richmond Park. Birds, Flowers and Trees.* Selwyn and Blount, London.

HANCOCK, B. D. 1964. Some observations on bats in east Surrey and recent records for the London area. *Lond. Nat.* **42:** 26-41.

HANSON, M. W. 1983. Lord's Bushes. The history and ecology of an Epping Forest woodland. *Essex Nat.* **7** (N.S.): 1-69.

HARTING, J. E. 1887. Horseshoe bats. *Zoologist* **11** (s. 3): 1-3.

HARTING, J. E. 1888. The whiskered bat. *Zoologist* **12** (s. 3): 161-166.

HARTING, J. E. 1889*a*. Daubenton's bat. *Zoologist* **13** (s. 3): 161-166.

HARTING, J. E. 1889*b*. Natterer's bat. *Zoologist* **13** (s. 3): 241-248.

HARTING, J. E. 1891. The serotine. *Zoologist* **15** (s. 3): 201-205.

HOBSON, J. M. 1924. *The Book of The Wandle – The Story of a Surrey River.* George Routledge & Sons Ltd, London.

HODGSON, S. B. 1954. Bats associating with birds. *Trans. Herts. nat. Hist. Soc.* **24** (2): 78.

HOLDSWORTH, E. W. H. 1858. Bat flying in sunshine. *Zoologist.* **16** (s. 1): 6257.

HOOPER, J. H. D. 1970. Listening for bats. *J. Hillingdon nat. Hist. Soc.* **1:** 16-18.

HOOPER, J. H. D. 1977. Use of the Holgate ultrasonic receiver to obtain bat distribution data in the Thames Valley and adjacent areas to the west of London. *Middle-Thames Nat.* **29:** 4-13.

HOOPER, J. H. D. 1981. The use of an ultrasonic receiver to obtain distribution data for pipistrelles and other bats within the London area. *Lond. Nat.* **60:** 47-63.

HUGGINS, H. C. 1956. Mammals. *S. Essex Nat.* 1955: 71-72.

HUTSON, A. M. 1986. Artificial bat cave in Kent. *Bat News* **9:** 7.

JESSE, E. 1834-5. *Gleanings in Natural History.* John Murray, London.

JOHNSON, W. 1910. *Battersea Park as a Centre for Nature Study.* T. Fisher Unwin, London.

JOHNSON, W. 1912. *Wimbledon Common.* T. Fisher Unwin, London.

JOHNSON, W. 1930. *The Nature World of London II, Animal Life in London.*

KELSALL, J. E. 1889. Distribution of Daubenton's bat in Britain. *Zoologist* **13** (s. 2): 308.

LAMBERT, A. 1843. Anecdote of a bat flying by daylight. *Zoologist* **1** (s. 1.): 35-36.

LAVER, H. 1898. *The Mammals, Reptiles and Fishes of Essex.* Essex Field Club Special Memoirs III.

LAVER, H. 1903. Mammals. Pp. 220-229. In: DOUBLEDAY, A. and PAGE, W. (Eds) *Victoria County History of Essex.* **1.** Westminster, London.

LEUTSCHER, A. 1974. *Epping Forest its History and Wildlife.* David and Charles, Newton Abbot.

LLOYD, B. 1947. Mammals. *Trans. Herts. nat. Hist. Soc.* **22** (5): 227-238.

LIVESLEY, P. 1969. Bats in Surrey. *Surrey Nat.* 1968: 40-44.

LYDEKKER, R. 1895. *A Handbook of the British Mammalia.* Allens Natural History Library **22.** Shaw, London.

MACGILLIVRAY, W. 1838. *A History of British Quadrupeds.* Jardine's Naturalist Library, **22.** Lizars, Edinburgh.

MACPHERSON, H. A. 1887. Lesser horseshoe bat in Herts and Kent. *Zoologist.* **11** (s. 3): 152.

MARTIN, B. 1902. Bats flying in broad daylight. *Field* **99,** No. 2572, 12 April: 561.

MARTIN, D. S. 1986. The survey of bat activities in Havering. (A summary of data collected so far and some tentative conclusions.) Pp. 8-20. In: DOBSON, J. *Essex Bat Group Report 1986.*

McCLAUCHLIN, J., WILLIAMS, L. R. and HARRISON, T. G. 1986. Artificial bat cave in London. *Bat News* **9:** 6.

MILLAIS, J. G. 1904-06. *The Mammals of Great Britain and Ireland.* Longmans, Green and Co., London.

MITFORD, R. 1860. Occurrence of a rare bat, the barbastelle *(Barbastellus daubentonii)* in the neighbourhood of London. *Zoologist* **17** (s. 1): 6953.

MORRIS, R. K. A. *et al.* 1984. *The Ecology of Mitcham Common (A report on the status of the flora and fauna).* The final report of the Ecological Survey of Mitcham Common.

NATURE CONSERVANCY. 1969. *Wimbledon Common: Management and Wildlife.*

NORGATE, F. 1906. Notes on the noctule *(Vesperugo noctula). Zoologist* **10** (s. 4): 26.

OLDHAM, C. 1907. Daubenton's bat *(Myotis daubentonii)* in Hertfordshire. *Zoologist* **11** (s. 4): 382.

OLDHAM, C. 1908. Barbastelle *(Barbastella barbastellus)* in Hertfordshire. *Zoologist* **12** (s. 4): 391-392.

PAINE, A. R. J. 1968. Mammal and Herptile Report No. 1. *Hillingdon nat. Hist. Soc.*

PAINE, A. R. J. 1969. Mammal and Herptile Report No. 2. *Hillingdon nat. Hist. Soc.*

PAINE, A. R. J. 1970. Mammal and Herptile Report No. 3. *Hillingdon nat. Hist. Soc.*

PAINE, A. R. J. 1971. Mammal report. *J. Hillingdon nat. Hist. Soc.* **2:** 8-15.

PENNANT, T. 1776-77. *British Zoology.* Class 1 Quadrupeds. W. Eyres, Warrington and B. White, London.

PENROSE, R. and other naturalists. 1985. *A Wood In Watford. Wildlife of Whipendell Wood. Secrets of Its Natural History: An Introduction for the student, layman and conservationist.*

PICKESS, B. P. 1955. Mammals recorded in the Ruislip area between 1951 and 1954. *J. Ruislip Distr. nat. Hist. Soc.* **4:** 14-15.

PICKESS, B. P. 1956. Mammals of the Ruislip area 1955. *J. Ruislip Distr. nat. Hist. Soc.* **5:** 13-14.

PICKESS, B. P. 1957. Mammals of the Ruislip area 1956. *J. Ruislip Distr. nat. Hist. Soc.* **6:** 33-34.

PICKESS, B. P. 1958. Mammals of the Ruislip area 1957. *J. Ruislip Distr. nat. Hist. Soc.* **7:** 24-26.

PICKESS, B. P. 1960. The natural history of a northwest Middlesex farm. *J. Ruislip Distr. nat. Hist. Soc.* **9:** 8-18.

PICKESS, B. P. 1963. The mammals of the Ruislip local nature reserve 1960-62. *J. Ruislip Distr. nat. Hist. Soc.* **12:** 9-12.

PICKESS, B. P. 1966. Mammal report for 1964-65. *J. Ruislip Distr. nat. Hist. Soc.* **15:** 22-25.

PUNNETT, A. H. 1906. Mammalia. *Bull. misc. Inf. R. bot. Gdns. Kew.* Additional Series V: 1-2 & 221.

RICHARDSON, P. W. 1985. *Bats.* Whittet Books, London.

RIGDEN, R. G. 1955. The fishes, amphibians, reptiles and mammals of Woolwich and surrounding localities. *Lond. Nat.* **34:** 48-53.

SAGE, B. (Ed.). 1966. *Northaw Great Wood: Its History and Natural History.* Herts. County Council.

SEEAR, M. 1964. Notes on the mammals of Essex. *Essex Nat.* **31:** 176-187.

SIDCUP AND DISTRICT NATURAL HISTORY SOCIETY. 1951. 2nd Annual Report.

SKINNER, J. F. 1976. *Wildlife of South East Essex.* Museum Series Publication No. 18. Southend Central Museum.

SMALLEY, F. W. 1911. Serotine bat in Essex. *Zoologist.* **15** (s. 4): 428.

SMEE, A. 1872. *My Garden.*

SOAMES, H. A. 1895. Mammalia. In: Bromley Naturalists Society: *List 1: Mammalia, Aves and Filices of the Bromley District.*

SOWAN, P. W. 1986. Letting the bats underground in east Surrey. *Bat News* **7:** 2-3.

STEBBINGS, R. E. 1986. *Which Bat Is It?* Mammal Society and Vincent Wildlife Trust, London.

STUBBS, F. J. 1917. The mammals of the London district. *School Nature Study:* 1-15.

TEAGLE, W. G. 1963. Mammals in the London area. A report for 1960 with some records for the years 1957-1959. *Lond. Nat.* **42:** 26-41.

TEAGLE, W. G. 1964. Mammals in the London area 1961. *Lond. Nat.* **43:** 119-135.

TEAGLE, W. G. 1965. Mammals in the London area 1962. *Lond. Nat.* **44:** 43-57.

TINNING, P. C. 1963. A brief summary of mammal recording for the year 1959-63 inclusive. *Darenthis* **3:** 23-26.

TRAPP, T. 1845. Bat flying in winter. *Zoologist* **3** (s. 1): 856.

TUCKER, D. G. 1947. The mammals and birds of Highams Park. *Lond. Nat.* **26:** 109-116.

TUTT, J. W. 1909. Mammalia, reptilia and amphibia. Pp. 234-236 & 255-256. In: GRINLING, C. H., INGRAM, T. A. & POLKINGTHORNE, B. C. (Eds.) *A Survey and Record of Woolwich and West Kent.* South East Union of Scientific Societies, Woolwich.

VESEY-FITZGERALD, B. 1949. *British Bats.* Methuen and Co., London.

WEBB, E. A., MILLER, G. W., and BECKWITH, J. 1899. *The History of Chislehurst.*

WEBSTER, A. D. 1901. The fauna and flora of Greenwich Park. *Trans. W. Kent nat. Hist. microsc. photogr. Soc.:* 16-25.

WEBSTER, A. D. 1902. *Greenwich Park: Its History and Associations.*

WEBSTER, A. D. 1911. *The Regent's Park and Primrose Hill. History and Antiquities.* Greening and Co., London.

WHITE, G. 1788. *The Natural History and Antiquities of Selborne in The County of Southampton: with engravings and an appendix.* B. White and Son, London. Published in the Penguin English Library 1977. Penguin Books Ltd, Harmondsworth.

WILMORE, A., WILMORE, A. N., GRAVESON, W., MORSE, R. and BICKERTON, W. 1925. *The Natural History of Hertfordshire.* G. Bell and Sons, London.

WOODROFFE, G. E. and SOUTHGATE, B. J. 1951. *Nycteribia latreillei* Leach (Diptera: Pupipara, Nycteribiidae) and *Spinturnix vespertilionis* (L.) (Acarina, Spinturnicidae) from bats at Godstone, Surrey. *Entomologist's mon. Mag.* **87:** 173.

YALDEN, D. W. 1985. *The Identification of British Bats.* Mammal Society, London.

APPENDICES

APPENDIX 1. Roost Sites in the L.N.H.S. Area, 1950-86.

The list of bat roosts is divided primarily by species. For each species it is subdivided by county. Within each county roosts are arranged by four-figure grid reference (referring to 1km squares). The 1st and 3rd figure of each four-figure reference refer to the appropriate 10km square (e.g. TQ 08 91 is in the 10km square TQ 0 9). The grid references are arranged as follows:

Starting with the 10km square in the NW corner of the county the references run west to east and work down the map north to south. Thus for pipistrelles in Greater London the sequence starts at TQ 0 9 then goes to 1 9, 2 9, 3 9 etc. to TQ 5 9. It continues with TQ 0 8, 1 8 etc. to TQ 6 8 and finishes with TQ 2 5 to 4 5.

For each roost a location is given in addition to the grid reference and for Greater London roosts the relevant borough is also shown. The date refers to the first date of discovery of the roost.

1. PIPISTRELLE 138 roosts

a. GREATER LONDON 74 roosts

Grid Ref.	*Location*	*Borough*	*Date*
TQ 09 91	Northwood	Hillingdon	1975
18 91	Edgware	Harrow	1986
24 94	Totteridge	Barnet	1986
24 95	Barnet	Barnet	1985
25 93	Woodside Park	Barnet	1985
27 95	East Barnet	Barnet	1985
32 98	Enfield	Enfield	1985
33 95	Enfield	Enfield	1986
37 93	Chingford	Waltham Forest	1985
38 93	Chingford	Waltham Forest	1986
40 92	Woodford Green	Redbridge	1986
53 92	Harold Hill	Havering	1985
53 92	Harold Hill	Havering	1985
55 90	Harold Wood	Havering	1985
55 92	Harold Hill	Havering	1985
05 83	Uxbridge	Hillingdon	1984
05 83	Uxbridge	Hillingdon	1984
06 86	Ickenham	Hillingdon	1975
07 85	Ickenham	Hillingdon	1986
07 85	Ickenham	Hillingdon	1985
07 85	Ickenham	Hillingdon	1985
09 87	Ruislip	Hillingdon	1986
13 82	Greenford	Ealing	1982
19 80	Acton	Ealing	1980
26 84	Swiss Cottage	Camden	1986
32 86	Highbury	Islington	1986
52 82	Rainham	Havering	1986
52 82	Rainham	Havering	1984
54 88	Hornchurch	Havering	1985
55 87	Hornchurch	Havering	1986
56 85	Upminster	Havering	1985
57 85	Upminster	Havering	1985
57 87	Cranham	Havering	1986
57 87	Cranham	Havering	1985
57 87	Upminster	Havering	1985
TQ 04 76	Longford	Hillingdon	1985
05 77	Harmondsworth	Hillingdon	1986
05 79	West Drayton	Hillingdon	1985
12 72	Hanworth	Hounslow	1985
16 71	Ham	Richmond	1983
16 73	Twickenham	Richmond	1985

Grid Ref.	*Location*	*Borough*	*Date*
16 75	Isleworth	Hounslow	1985
16 76	Isleworth	Hounslow	1973
17 71	Ham Common	Richmond	1985
18 74	Richmond	Richmond	1985
20 70	Kingston	Kingston	1983
20 77	Chiswick	Hounslow	1985
20 77	Chiswick	Hounslow	1983
22 71	Wimbledon	Merton	1983
22 73	Roehampton	Wandsworth	1986
22 74	Putney	Wandsworth	1983
23 71	Wimbledon	Merton	1985
23 72	Wimbledon	Wandsworth	1986
24 72	Wimbledon	Wandsworth	1985
24 72	Wimbledon	Wandsworth	1976
24 74	Putney	Wandsworth	1985
24 74	Putney	Wandsworth	1985
37 70	Beckenham	Bromley	1986
43 77	Woolwich	Greenwich	1986
51 72	Bexley	Bexley	1985
18 67	Surbiton	Kingston	1984
23 65	Worcester Park	Sutton	1986
27 67	Mitcham	Merton	1986
28 65	Wallington	Sutton	1986
28 65	Wallington	Sutton	1985
28 65	Wallington	Sutton	1985
32 60	Purley	Croydon	1986
32 61	Sanderstead	Croydon	1983
38 61	New Addington	Croydon	1985
47 65	Orpington	Bromley	1986
47 65	Orpington	Bromley	1985
40 58	Biggin Hill	Bromley	1985
41 59	Biggin Hill	Bromley	1986
44 54	Biggin Hill	Bromley	1983

b. SURREY 39 roosts

Grid Ref.	*Location*	*Date*
TQ 03 72	Staines	1985
02 68	Thorpe	1986
07 64	Weybridge	1986
07 65	Weybridge	1985
07 65	Weybridge	1985
08 61	Byfleet	1986
09 62	Walton-on-Thames	1985
09 63	Walton-on-Thames	1986
10 64	Walton-on-Thames	1985
10 68	Sunbury-on-Thames	1985
11 69	Sunbury-on-Thames	1986
11 69	Sunbury-on-Thames	1985
11 69	Sunbury-on-Thames	1985
13 63	Esher	1985
13 69	East Molesey	1985
14 60	Oxshott	1985
14 64	Esher	1986
14 64	Esher	1984
14 64	Esher	1983
15 65	Hinchley Wood	1985
14 54	Great Bookham	1986
14 54	Great Bookham	1982
16 59	Leatherhead	1984
17 52	Mickleham	1986
17 54	Givons Grove	1979
20 54	Headley	1985

Grid Ref.	*Location*	*Date*
22 54	Walton-on-the-Hill	1986
24 55	Kingswood	1983
31 50	Bletchingley	1980
31 55	Chaldon	1985
32 50	Bletchingley	1982
32 55	Caterham	1982
33 54	Caterham	1984
34 51	Godstone	1956
34 55	Caterham	1985
35 51	Godstone	1956
39 51	Oxted	1983
40 55	Titsey	1980
42 58	Westerham	1980

c. KENT 7 roosts

TQ 50 71	Bexley	1985
54 74	Dartford	1983
48 60	Knockholt	1985
48 61	Halstead	1986
55 62	Sevenoaks	1985
57 63	West Kingsdown	1982
44 54	Westerham	1983

d. ESSEX 11 roosts

TL 41 10	Roydon	1986
41 09	Roydon	1983
41 09	Roydon	1982
TQ 39 95	Chingford	1986
41 93	Buckhurst Hill	1970s
41 99	Loughton	1986
42 96	Loughton	1983
43 93	Chigwell	1985
46 93	Chigwell	1985
61 90	Thorndon Park	1950
61 78	Grays	1982

e. HERTFORDSHIRE 7 roosts

TL 32 12	Hertford Heath	1983
32 13	Hertford	1986
34 02	Cheshunt	1986
37 09	Hoddesdon	1983
TQ 05 95	Rickmansworth	1985
05 96	Loudwater	1986
09 98	Watford	1985

2. SEROTINE 21 roosts

a. GREATER LONDON 3 roosts

Grid Ref.	*Location*	*Borough*	*Date*
TQ 45 63	Green Street Green	Bromley	1979
46 63	Orpington	Bromley	1985
48 64	Chelsfield	Bromley	1985

b. SURREY 12 roosts

Grid Ref.	*Location*	*Date*
TQ 10 66	Walton-on-Thames	1985
11 64	Hersham	1986
11 64	Hersham	1965
13 64	Esher	1967

Grid Ref.	*Location*	*Date*
17 52	Mickleham	1986
22 51	Buckland	1985
27 59	Woodmansterne	1976
32 50	Bletchingley	1957
34 51	Godstone	1959
36 58	Warlingham	1984
39 51	Oxted	1963
40 50	Oxted	1980

c. KENT 3 roosts

TQ 57 71	Darenth	1983
53 65	Eynsford	1985
56 64	Farningham	1983

d. ESSEX 2 roosts

TL 52 07	Ongar	1986
TQ 50 99	Stapleford Tawney	1986

e. HERTFORDSHIRE 1 roost

TL 38 11	Stansted Abbots	1984

3. NOCTULE 6 roosts

a. GREATER LONDON 4 roosts

Grid Ref.	*Location*	*Borough*	*Date*
TQ 32 98	Enfield	Enfield	1986
26 87	Hampstead Heath	Camden	1985
28 88	Highgate Woods	Haringey	1986
13 79	Osterley Park	Hounslow	1984

b. SURREY 2 roosts

Grid Ref.	*Location*	*Date*
TQ 10 65	Walton-on-Thames	1986
13 64	Esher	1960

4. LONG-EARED 18 roosts

a. GREATER LONDON 3 roosts

Grid Ref.	*Location*	*Borough*	*Date*
TQ 47 71	Sidcup	Bexley	1986
47 63	Chelsfield	Bromley	1982
42 58	Biggin Hill	Bromley	1986

b. SURREY 14 roosts

Grid Ref.	*Location*	*Date*
TQ 09 58	Cobham	1985
13 56	Fetcham	1986
13 57	Stoke D'Abernon	1986
16 59	Oxshott	1986
21 51	Betchworth	1986
22 54	Walton-on-the-Hill	1986
26 50	Redhill	1985
27 56	Chipstead	1985
37 50	Tandridge	1986
40 53	Limpsfield	1985
40 55	Titsey	1980
41 52	Limpsfield	1984
42 50	Limpsfield	1984
42 51	Limpsfield	1986

c. KENT 1 roost

Grid Ref.	*Location*	*Date*
TQ 53 56	Sevenoaks	1986

5. DAUBENTON'S 2 roosts

a. GREATER LONDON 1 roost

Grid Ref.	*Location*	*Borough*	*Date*
TQ 07 85	Ickenham	Hillingdon	1977

b. KENT 1 roost

Grid Ref.	*Location*	*Date*
TQ 50 56	Chipstead	1979

6. BRANDT'S 1 roost

a. GREATER LONDON 1 roost

Grid Ref.	*Location*	*Borough*	*Date*
TQ 05 83	Uxbridge	Hillingdon	1984

7. UNIDENTIFIED SPECIES 244 roosts

a. GREATER LONDON 80 roosts

Grid Ref.	*Location*	*Borough*	*Date*
TQ 07 90	Northwood	Hillingdon	1970
08 90	Northwood	Hillingdon	1986
10 90	Northwood	Hillingdon	1982
15 90	Harrow Weald	Harrow	1984
16 92	Stanmore	Harrow	1985
18 91	Edgware	Harrow	1979
19 93	Edgware	Barnet	1986
20 91	Burnt Oak	Barnet	1986
21 90	Hendon	Barnet	1985
24 94	Totteridge	Barnet	1986
24 94	Totteridge	Barnet	1985
24 96	Barnet	Barnet	1983
26 98	Hadley Wood	Enfield	1985
27 94	East Barnet	Barnet	1985
31 97	Enfield	Enfield	1986
31 98	Enfield	Enfield	1986
32 96	Enfield	Enfield	1984
32 96	Enfield	Enfield	1983
32 96	Enfield	Enfield	1983
38 91	Highams Park	Waltham Forest	1985
38 92	Chingford	Waltham Forest	1986
38 93	Chingford	Waltham Forest	1985
38 93	Chingford	Waltham Forest	1982
39 91	Woodford Green	Redbridge	1985
43 91	Woodford Green	Redbridge	1985
07 86	Ickenham	Hillingdon	1986
07 86	Ickenham	Hillingdon	1985
07 86	Ickenham	Hillingdon	1984
07 86	Ickenham	Hillingdon	1984
07 86	Ickenham	Hillingdon	1983
09 81	Hayes	Hillingdon	1986
13 88	Harrow	Harrow	1982
25 88	Golders Green	Barnet	1986
26 88	Hampstead Garden Suburb	Barnet	1983
29 84	Camden Town	Camden	1986
30 87	Finsbury Park	Haringey	1986
44 85	Ilford	Redbridge	1984
54 88	Emerson Park	Havering	1985

Grid Ref.	*Location*	*Borough*	*Date*
05 77	Harmondsworth	Hillingdon	1986
05 79	West Drayton	Hillingdon	1986
05 79	West Drayton	Hillingdon	1986
06 79	West Drayton	Hillingdon	1984
16 72	Ham	Richmond	1982
16 73	Twickenham	Richmond	1983
16 74	Twickenham	Richmond	1986
18 76	Kew	Richmond	1984
20 75	Mortlake	Richmond	1983
20 77	Chiswick	Hounslow	1986
20 77	Chiswick	Hounslow	1985
20 77	Chiswick	Hounslow	1982
22 73	Putney Heath	Wandsworth	1985
22 74	Putney Heath	Wandsworth	1984
23 73	Putney Heath	Wandsworth	1985
24 74	Putney	Wandsworth	1986
24 75	Putney	Wandsworth	1983
27 76	Battersea	Wandsworth	1983
33 70	Crystal Palace	Bromley	1984
42 70	Chislehurst	Bromley	1985
50 75	Bexley	Bexley	1984
18 67	Surbiton	Kingston	1985
18 67	Surbiton	Kingston	1985
18 67	Surbiton	Kingston	1985
22 65	Worcester Park	Sutton	1985
23 66	Morden	Merton	1986
28 62	Wallington	Sutton	1985
28 66	Carshalton	Sutton	1972
28 66	Carshalton	Sutton	1972
32 63	Sanderstead	Croydon	1985
33 65	Selsdon	Croydon	1983
37 69	Beckenham	Bromley	1982
41 64	Keston	Bromley	1986
41 69	Bromley	Bromley	1985
41 69	Bromley	Bromley	1983
41 69	Bromley	Bromley	1983
44 64	Farnborough	Bromley	1982
44 65	Orpington	Bromley	1984
47 65	Orpington	Bromley	1986
41 59	Biggin Hill	Bromley	1986
41 59	Biggin Hill	Bromley	1983
45 59	Cudham	Bromley	1986

b. SURREY 53 roosts

Grid Ref.	*Location*	*Date*
TQ 02 72	Staines	1984
04 71	Staines	1984
04 71	Staines	1983
06 71	Ashford	1982
09 70	Sunbury-on-Thames	1985
02 63	Ottershaw	1985
04 64	Addlestone	1986
04 64	Addlestone	1983
04 66	Chertsey	1986
05 62	New Haw	1980
05 63	Addlestone	1986
06 61	Byfleet	1986
06 64	Weybridge	1986
07 64	Weybridge	1986
07 64	Weybridge	1986
07 64	Weybridge	1984
07 64	Weybridge	1984
07 64	Weybridge	1983

Grid Ref.	*Location*	*Date*
08 63	Weybridge	1985
08 67	Shepperton	1984
08 67	Shepperton	1983
09 64	Weybridge	1985
10 60	Cobham	1985
10 60	Cobham	1983
10 66	Walton-on-Thames	1985
10 68	Sunbury-on-Thames	1985
10 68	Sunbury-on-Thames	1985
10 68	Sunbury-on-Thames	1983
10 69	Sunbury-on-Thames	1982
16 63	Claygate	1986
21 60	Epsom Down	1984
22 63	Ewell	1986
22 63	Stoneleigh	1986
12 54	Little Bookham	1986
12 55	Little Bookham	1983
12 57	Cobham	1986
12 59	Stoke D'Abernon	1985
16 56	Leatherhead	1984
16 56	Leatherhead	1984
16 56	Leatherhead	1983
16 56	Leatherhead	1983
16 56	Leatherhead	1982
17 53	Mickleham	1983
19 58	Ashtead	1986
20 59	Epsom	1985
24 55	Kingswood	1983
25 50	Reigate	1982
25 55	Kingswood	1986
25 59	Banstead	1983
33 54	Caterham	1986
37 55	Woldingham	1982
37 58	Warlingham	1986
41 52	Limpsfield	1983

c. KENT 19 roosts

TQ 53 74	Dartford	1986
54 73	Dartford	1985
54 74	Dartford	1984
58 72	Bean	1984
54 62	Eynsford	1986
57 61	West Kingsdown	1986
57 62	West Kingsdown	1985
58 62	West Kingsdown	1985
58 62	West Kingsdown	1984
60 68	Longfield	1984
61 66	Hartley	1984
44 54	Westerham	1985
44 54	Westerham	1985
45 57	Knockholt	1986
47 59	Knockholt	1985
48 54	Ide Hill	1985
50 55	Chipstead	1985
53 56	Sevenoaks	1985
53 59	Ide Hill	1983

d. ESSEX 34 roosts

TL 45 10	Harlow	1985
45 10	Harlow	1984
45 10	Harlow	1983
45 10	Harlow	1983

Grid Ref.	*Location*	*Date*
45 10	Harlow	1982
45 10	Harlow	1982
45 10	Harlow	1982
37 09	Hoddesdon	1982
38 00	Waltham Abbey	1983
39 06	Nazeing	1986
40 09	Roydon	1985
41 06	Nazeing	1984
41 06	Nazeing	1984
41 09	Roydon	1983
41 09	Roydon	1983
41 09	Roydon	1983
46 02	Epping	1986
46 02	Epping	1985
46 02	Epping	1984
49 04	North Weald	1983
51 02	Ongar	1983
53 00	Standford Rivers	1985
54 00	Standford Rivers	1982
TQ 41 93	Buckhurst	1983
41 93	Buckhurst	1983
42 96	Loughton	1982
45 99	Theydon Bois	1985
46 93	Chigwell	1984
46 96	Abridge	1984
60 91	Thorndon Park	1986
60 91	Thorndon Park	1986
60 94	Shenfield	1983
59 82	South Ockenden	1983
61 78	Grays	1985

e. HERTFORDSHIRE 54 roosts

TL 25 12	Welwyn Garden City	1986
28 10	Hertford	1984
32 12	Hertford	1983
34 11	Hertford Heath	1986
38 11	Stansted Abbots	1984
38 11	Stansted Abbots	1984
38 11	Stansted Abbots	1983
07 02	Kings Langley	1985
08 00	Hunton Bridge	1986
09 02	Abbots Langley	1985
09 02	Abbots Langley	1983
09 03	Bedmond	1986
12 02	Brickett Wood	1985
14 03	Park Street	1983
14 04	St Albans	1986
15 07	St Albans	1984
15 07	St Albans	1983
15 07	St Albans	1983
15 07	St Albans	1983
15 07	St Albans	1982
23 09	Hatfield	1984
23 09	Hatfield	1984
23 09	Hatfield	1982
25 01	Potters Bar	1982
27 08	Essendon	1985
27 08	Essendon	1983
28 02	Northaw	1983
29 08	L. Berkhampsted	1984
30 02	Cuffley	1985

Grid Ref.	*Location*	*Date*
30 02	Cuffley	1983
30 05	Newgate Street	1983
34 00	Enfield	1970s
35 02	Cheshunt	1983
37 07	Broxbourne	1983
37 07	Broxbourne	1983
37 09	Ware	1983
37 09	Hoddesdon	1986
37 09	Hoddesdon	1986
37 09	Hoddesdon	1985
TQ 02 95	Chorleywood	1982
11 93	Carpenders Park	1982
11 96	Watford	1986
11 96	Watford	1985
11 96	Watford	1984
11 96	Watford	1984
11 96	Watford	1984
11 96	Watford	1984
11 97	Watford	1984
11 99	Garston	1986
12 98	Garston	1986
13 95	Bushey	1983
17 95	Elstree	1983
18 99	Shenley	1986
18 99	Shenley	1986

f. BUCKINGHAMSHIRE 4 roosts

TQ 02 95	Chorleywood	1984
00 88	Gerrards Cross	1983
03 86	Denham	1973
02 77	Colnbrook	1984

APPENDIX 2. Results of Feeding Area Survey, 1985-86.

The results are divided into areas within the G.L.C. boundary and those outside. For the G.L.C. area sites are divided primarily by borough and secondarily by grid reference. The sequence of grid references is as described in Appendix 1. The dates of visits, the number of visits, the maximum number seen on any one visit and the species found are also shown.

All positive identifications of species are based on using bat detectors coupled with flight observations. Noctule and Leisler's bats are not separated in the table since their calls are very similar on bat detectors.

KEY: Maximum number seen: a = 1 to 5 bats
b = 6 to 20 bats
c = 20+ bats

Species: P = Pipistrelle bats
N = *Nyctalus* species (Noctule or Leisler's bats)
D = Daubenton's bats
S = Serotine bats
U = Unidentified species

FEEDING AREA SURVEY 1985-86: G.L.C. AREA

1. BARKING and DAGENHAM

		Visited		*No. of*	*Max. No.*	
Grid Ref.	*Location*	*1985*	*1986*	*Visits*	*seen*	*Species*
TQ 46 84	Mayesbrook Park	+	+	2	a	N,P
46 85	Mayesbrook Park	+	+	2	a	N,P
47 84	Dagenham, Gale Street	+		1	a	U
50 83	Beam River	+		1	a	N,U
50 84	Beam River	+		1	a	N,U
51 84	Beam River	+		1	a	N,U

Grid Ref.	*Location*	*Visited* 1985	*Visited* 1986	*No. of Visits*	*Max. No. seen*	*Species*
2. BARNET						
TQ 20 93	Deans Brook	+		1	b	2U
20 94	Scratchwood	+		1	a	U
21 90	Graeme Park Pond		+	1	a	2U
21 93	Moat Mount	+		1	a	U
21 94	Moat Mount	+	+	2	c	U
21 96	Rowley Green S.S.S.I.		+	1	a	U
22 90	Sunny Hill Park	+	+	3	a	U
22 90	Hendon, Copthall		+	1	a	U
22 94	Mays Lane		+	1	–	U
23 94	Totteridge Long Pond		+	1	a	U
23 96	Arkley, Barnet Road		+	1	a	U
23 97	Barnet, Calvert Road		+	1	a	U
24 90	No Location	+		1	–	U
24 90	Hendon Cemetery		+	1	a	U
24 91	Rocklands Pond, Dollis Brook	+	+	2	b	U
24 93	Windy Ridge		+	1	–	U
24 93	Darland's Lake	+	+	6	b	N,P
24 94	No Location	+		1	–	U
24 96	Barnet, Hillside Gardens	+		1	a	U
24 97	Barnet, Calvert Road		+	1	a	U
25 91	Dollis Brook		+	1	–	U
25 92	Folly Brook		+	1	–	U
25 93	Dollis Brook		+	1	–	U
25 93	Whetstone Stray		+	1	a	U
25 94	Totteridge Lane	+	+	2	a	U
25 95	Greenhill Park Lake		+	1	b	N,P
25 95	Barnet, Sherrards Way		+	1	a	U
25 96	No Location	+		1	–	U
25 96	New Barnet, Tudor Road		+	1	a	U
25 96	King Georges Fields		+	1	a	U
25 97	No Location	+		1	–	U
25 97	Hadley Wood and Common		+	1	a	U
26 93	Birley Road Lakes		+	1	a	U
26 94	Oakleigh Park, Oakleigh Gardens	+		1	a	U
26 97	No Location	+		1	–	U
26 97	King Georges Fields		+	1	a	U
27 91	Coppets Wood	+		1	–	2U
27 94	Oak Hill Park	+	+	3	a	P,U
27 95	No Location	+		1	–	U
27 95	New Barnet, Crescent Road		+	1	a	U
27 96	No Location	+		1	–	U
27 97	Beech Hill Lake	+	+	11	b	P,N,D
28 92	Friern Barnet, Parkhurst Road		+	1	a	U
28 95	Oak Hill Woods	+		1	a	U
21 87	Brent Reservoir	+	+	8	b	P,N
21 88	Brent Reservoir	+		1	b	P
22 86	No Location		+	1	–	U
22 87	Upper Welsh Harp		+	1	a	U
24 88	Brent Park	+	+	2	b	U
24 89	College Farm	+	+	2	a	U
25 86	Golders Hill Park	+	+	35	b	2U
3. BEXLEY						
TQ 47 80	Thamesmead, Southmere	+		1	a	U
47 80	Thamesmead, Crossway Park	+		1	a	U
47 81	Thamesmead, Crossway Lake	+		1	a	U
48 80	Crossness Sewage Works	+		1	a	U
46 73	Sidcup Golf Course	+		2	a	U
46 73	Lamorbey Park	+		1	b	U
47 73	Bexley, Penhill Road	+		1	a	U

Grid Ref.	*Location*	*Visited* 1985	1986	*No. of Visits*	*Max. No. seen*	*Species*
47 79	Thamesmead, Southmere	+		1	a	U
48 71	Sidcup, Parsonage Lane	+		1	a	U
48 71	Sidcup, River Cray		+	1	b	P
48 72	Sidcup, River Cray		+	1	a	U
48 78	Lesnes Abbey Wood	+		1	a	U
48 79	Thamesmead, Aspen Green	+		1	a	U
49 71	Sidcup, Parsonage Lane	+		1	a	U
49 73	Bexley, Blue Anchor	+		1	a	U
49 74	Bexleyheath, Gravel Hill Close	+		1	a	U
50 75	Barnehurst Woods	+		1	a	U
50 75	Martens Grove Park		+	1	–	U
4. BRENT						
TQ 16 84	Grand Union Canal		+	1	b	U
16 87	Harrow School		+	1	b	U
17 83	Grand Union Canal		+	1	b	U
17 84	Grand Union Canal		+	1	b	U
17 85	Barham Park		+	1	a	U
17 88	Woodcock Park		+	1	a	U
18 83	Grand Union Canal		+	1	b	U
19 83	Grand Union Canal		+	1	a	U
19 87	Fryent Park	+		1	b	P
19 88	Fryent Park	+		1	a	P
20 86	Kingsbury, St Andrews Church	+		3	a	U
20 87	Brent Reservoir	+		1	a	U
21 86	Brent Reservoir		+	1	b	2U
21 87	Brent Reservoir	+	+	3	b	2U
22 85	Gladstone Park	+	+	4	a	U
5. BROMLEY						
TQ 34 70	Crystal Palace Park	+	+	4	a	U
34 70	Crystal Palace Park Road	+		1	a	U
34 70	Crystal Palace Tunnel	+		1	a	U
34 71	Crystal Palace Park		+	1	b	2U
41 70	Sundridge Park	+		1	a	P
42 71	Mottingham, Dittisham Road	+		1	b	U
38 66	West Wickham, Hawes Lane	+		1	a	U
38 69	Beckenham, Oakwood Avenue	+		1	a	U
39 67	West Wickham, The Crescent	+		1	a	U
40 60	Jewels Wood	+		2	a	U
40 69	Bromley, High Street	+		1	a	U
41 64	Keston Common	+		13	a	2U
41 66	Hayes Trout Fishery		+	6	c	2U
43 65	Orpington, Highwood Drive	+		1	b	U
45 63	Green Street Green, High Street	+		1	a	U
46 69	Bickley, Pines Road	+		1	a	U
47 61	Fairtrough Farm	+		2	a	U
39 58	Mollards Wood	+		1	a	U
41 59	Biggin Hill, Sunningvale Avenue	+		1	a	U
43 57	Buckhurst	+		5	a	2U
44 57	Buckhurst	+		6	a	2U
6. CAMDEN						
TQ 25 86	West Heath	+	+	13	b	P,U
26 86	Hampstead Heath	+		2	a	P
27 85	Hampstead Heath		+	1	a	U
27 86	Hampstead Heath	+	+	5	b	P,N,D
27 87	Hampstead Heath	+		4	a	P,N
28 84	Chalk Farm		+	1	–	U
28 84	Grand Union Canal		+	2	a	P
28 84	Camden Lock		+	1	–	U

Grid Ref.	*Location*	*Visited* 1985	1986	*No. of Visits*	*Max. No. seen*	*Species*
28 86	Hampstead Heath	+	+	2	a	2U
28 86	Highgate Cemetery	+	+	3	a	P,N
28 87	Highgate Cemetery	+	+	1	a	P
28 87	Hampstead Heath	+		1	b	P,N
29 83	Grand Union Canal		+	1	a	P
30 83	Grand Union Canal		+	1	a	P

7. CITY OF LONDON

No feeding records received

8. CITY OF WESTMINSTER

TQ 26 80	Hyde Park	+		4	a	P
26 80	Kensington Gardens	+		1	a	U
27 80	Hyde Park	+		5	b	P,N
27 82	Regents Park	+	+	6	b	P,N
27 82	Grand Union Canal		+	1	a	P
26 79	Hyde Park	+		1	a	U

9. CROYDON

TQ 32 70	Dulwich, Upper Wood	+		1	a	U
32 62	South Croydon, Penwortham Road	+		2	a	U
34 68	South Norwood, Pittville Gardens	+		1	a	U
34 69	South Norwood Lake		+	1	–	U
36 65	Croydon, Stuart Crescent	+		1	a	U
38 61	New Addington, Overbury School	+		2	a	N,U
31 56	Coulsdon Common	+		2	a	U
31 59	Kenley, Firs Road	+		1	a	U

10. EALING

10 83	Northolt, Yeading Valley Park		+	1	a	U
12 81	Grand Union Canal		+	1	a	U
12 82	Grand Union Canal		+	1	a	U
12 83	Northolt, Lilliput Avenue		+	1	a	U
13 83	Grand Union Canal		+	1	a	U
14 80	Southall, Dormers Wells	+		1	b	2U
14 80	Brent River Park	+	+	2	b	P,N
14 80	Grand Union Canal		+	1	a	P
14 81	Brent River Park	+	+	2	b	U
14 81	Grand Union Canal		+	1	a	2U
14 82	Greenford, Betham Road	+		1	–	U
14 82	Brent River Park		+	2	a	U
14 82	Litten Nature Reserve		+	1	a	2U
14 82	Ravenor Park		+	1	a	U
14 84	Grand Union Canal		+	1	a	U
15 80	Brent River Park		+	1	a	2U
15 82	Brent River Park		+	1	b	U
15 83	Grand Union Canal		+	1	a	U
15 84	Grand Union Canal		+	2	a	U
16 83	Grand Union Canal	+	+	4	a	2U
16 84	Grand Union Canal		+	1	a	U
17 80	Ealing, Ealing Green Church		+	1	a	U
17 80	Ealing, Walpole Park		+	1	a	U
17 82	Pittshanger Park		+	1	a	U
17 83	Grand Union Canal		+	1	a	2U
17 84	Grand Union Canal		+	1	a	U
18 80	Ealing Common	+	+	2	a	U
18 82	Ealing, Fox Wood	+		1	a	U
19 81	Acton, Churchill Gardens		+	1	a	U
21 80	Acton, Sports Ground		+	1	a	U

Grid Ref.	*Location*	*Visited* 1985	1986	*No. of Visits*	*Max. No. seen*	*Species*
11 79	Grand Union Canal		+	1	a	U
14 79	Grand Union Canal	+	+	7	b	U
15 76	Boston Manor, Southdown Avenue	+		1	a	U
15 79	Grand Union Canal	+	+	3	a	N
15 79	River Brent		+	1	a	N
15 79	Elthorne Park Extension		+	8	a	U
16 78	Grand Union Canal	+		2	a	U
16 79	Hanwell, Playing Field	+		1	a	U
18 79	Barrons Pond		+	1	a	U
20 78	Gunnersbury Triangle	+		1	–	U
11. ENFIELD						
TQ 28 95	Cat Hill Lake		+	1	b	P
28 96	Trent Park	+		2	b	P
29 96	Eastpole Farm Lake		+	1	a	P
29 97	Trent Park	+		2	b	P,N
30 96	Boxers Lake		+	1	b	P
30 96	Enfield, Cotswolds Way		+	1	a	P
30 96	Enfield, Worlds End Lane		+	1	a	P
31 96	Enfield, Worlds End		+	1	a	P
32 96	New River, Enfield Town		+	1	a	P
34 98	New River, Goat Lane		+	1	c	P,N,D
12. GREENWICH						
TQ 45 80	Tripcock Park Woodland	+		1	a	U
45 80	Woolwich Arsenal Ranges	+		1	a	U
46 80	Thamesmead, Birchmere	+		1	a	U
46 80	Thamesmead, Tump 53 Pond	+		1	a	U
46 80	Thamesmead, Twin Tumps Pond	+		1	a	U
46 81	Thamesmead, Thamesmere	+		1	a	U
39 77	Greenwich Park	+		1	a	P,N
43 75	Shepherdleas Wood	+		1	a	U
43 76	Oxleas Woods	+		2	a	P,N
44 75	Oxleas Woods	+		2	a	U
45 78	Plumstead, Lakedale Road	+		1	a	U
13. HACKNEY						
TQ 32 87	Hackney, Woodberry Down		+	1	b	U
33 83	Grand Union Canal		+	1	a	P
33 86	Abney Park Cemetery	+		1	a	U
34 87	Springfield Park	+		2	a	U
34 87	Upper Clapton, Sports Ground	+		1	a	U
35 87	Walthamstow Marsh	+		1	a	U
35 87	Warwick Reservoir	+		1	a	U
35 87	River Lea	+		1	a	U
14. HAMMERSMITH and FULHAM						
TQ 23 80	Wood Lane		+	1	–	U
21 79	Shepherds Bush, Cobbold Road	+		1	a	U
25 76	Parsons Green, South Park	+		1	a	U
15. HARINGEY						
TQ 30 90	Alexandra Palace Park	+		1	b	P,N
35 90	Lockwood Reservoir		+	1	a	N
28 88	Highgate Wood	+	+	2	b	P,N
30 89	Wood Green Reservoir	+		2	a	U
34 88	Warwick Reservoir East		+	1	a	P
34 88	Warwick Reservoir West		+	1	b	N
34 89	Tottenham Hale, Ferry Lane		+	1	a	P,N
34 89	Tottenham Hale, Makefield Road	+		1	a	U

Grid Ref.	*Location*	*Visited* 1985	*Visited* 1986	*No. of Visits*	*Max. No. seen*	*Species*
16. HARROW						
TQ 10 91	Pinner Hill Golf Club		+	1	a	P
11 91	Pinner Hill Golf Club		+	1	a	P
14 93	Harrow Weald Common	+		1	a	U
15 92	Bentley Priory	+	+	4	a	P
16 92	Bentley Priory	+	+	4	b	P,N
17 95	Aldenham Country Park		+	1	c	2U
15 87	Harrow School		+	1	b	P
17. HAVERING						
TQ 49 92	Collier Row, Grimstone Close	+		1	–	U
53 92	Harold Hill, Sevenoaks Close	+		1	–	U
54 90	Haroldwood Park	+		1	a	U
49 88	Gamefield	+		1	a	U
52 82	Rainham, The Glen	+		1	a	U
53 83	Berwick Pond		+	1	b	P,S
54 83	Berwick Pond	+	+	4	c	P,N,S
54 88	Burnt House Wood		+	1	b	P
18. HILLINGDON						
TQ 04 88	South Harefield Reservoirs		+	1	b	2U
05 86	Grand Union Canal		+	1	b	P,N,D
05 87	Grand Union Canal		+	1	b	P,N
06 85	Ickenham, Windrush Close	+		1	a	U
06 88	Bayhurst Woods	+		1	b	P,N
08 89	Ruislip Lido	+	+	3	b	P,U
09 81	Hayes, Woodstock Gardens		+	1	–	U
09 89	Ruislip Lido	+		1	a	P
19. HOUNSLOW						
TQ 14 77	Osterley Park	+	+	3	b	P,N
14 78	Osterley Park	+	+	4	c	P,N
15 78	Osterley Park	+		2	b	P,U
17 76	Syon Park		+	1	a	U
20 77	Chiswick, Sutton Court Road	+		1	a	U
20 77	Chiswick, Dukes Meadow		+	1	a	U
20 77	Chiswick House		+	1	a	P,N,D
20 78	Chiswick, Hadley Gardens		+	1	a	U
21 76	Chiswick, Dukes Meadow		+	1	a	U
20. ISLINGTON						
TQ 30 83	Grand Union Canal		+	1	a	P
31 83	Grand Union Canal		+	1	a	P
31 85	Highbury Fields		+	1	–	U
21. KENSINGTON and CHELSEA						
TQ 23 82	Grand Union Canal	+		1	a	P
24 79	Holland Park House	+		1	a	U
22. KINGSTON-UPON-THAMES						
TQ 18 70	Kingston, The Keep	+		1	a	U
16 62	Chessington, Winey Hill		+	1	b	P,N
17 62	Chessington, Winey Hill		+	1	a	P,S
17 63	Chessington, Winey Hill		+	1	a	S
17 66	Surbiton, Woodlands Avenue	+		1	a	U
18 68	Kingston, Geneva Road	+		1	a	U
19 66	Berrylands, Raeburn Avenue	+		1	a	U
20 69	Kingston, Albion Road		+	1	–	U

Grid Ref.	*Location*	*Visited* 1985	1986	*No. of Visits*	*Max. No. seen*	*Species*
23. LAMBETH						
TQ 29 71	Tooting Bec Common	+		3	a	U
29 72	Tooting Bec Common	+		3	a	U
32 72	West Norwood Cemetery	+		1	a	N
24. LEWISHAM						
TQ 35 72	Forest Hill, Dacres Road	+		1	a	U
37 72	Bellingham Lido	+		1	–	U
38 75	Lewisham, Belmont Hill		+	1	–	U
39 71	Lewisham, Downham Way	+		1	a	U
39 75	Blackheath, Hatcliffe Close		+	1	–	U
39 76	Blackheath		+	1	a	U
39 76	Blackheath, Montpelier Row	+		2	a	U
39 76	Blackheath, Eliot Cottages	+		1	b	U
41 72	Grove Park Hospital	+		1	–	U
25. MERTON						
TQ 23 70	Wimbledon Common		+	1	a	N
23 71	Wimbledon Common	+	+	4	b	P,D
23 71	Kingston Vale	+		1	a	U
24 72	Wimbledon Park	+		2	b	U
25 72	Wimbledon Park	+		1	a	U
22 69	New Malden, Coombe Lane	+		1	–	U
23 66	Morden, Lynmouth Avenue		+	1	–	U
24 68	Cannon Hill Common	+		2	a	U
28 67	Mitcham, Carshalton Road		+	1	a	U
26. NEWHAM						
TQ 41 83	West Ham, Upton Park	+		1	a	U
41 86	Wanstead Flats	+	+	4	b	P,N,U
27. REDBRIDGE						
TQ 40 92	Woodford Green		+	1	a	U
41 92	Woodford Green, Hillside Avenue		+	1	a	U
40 87	Bush Wood		+	1	a	U
40 87	Wanstead Park		+	3	a	2U
41 87	Wanstead Park	+	+	5	b	P,N
42 87	Wanstead Park		+	1	a	P
28. RICHMOND-UPON-THAMES						
TQ 12 72	Twickenham, Crane Park	+		1	a	U
13 70	Hampton, Milton Road	+		2	a	U
14 71	Teddington, Oxford Road	+		5	a	U
16 72	Teddington, Radnor Gardens	+		1	a	U
16 73	River Thames	+		1	a	U
17 73	River Thames	+	+	3	c	P,N,D
17 73	Marble Hill Park	+		1	a	U
17 74	River Thames	+		2	a	2U
17 75	River Thames	+		2	a	U
17 76	River Thames	+		1	a	U
18 73	Richmond Park	+		1	a	P
18 73	Richmond Hill	+		1	a	U
18 73	River Thames	+		1	a	U
18 74	River Thames	+		2	b	P,U
18 76	Kew Gardens Lake	+		1	a	U
18 77	River Thames	+		3	b	U
19 70	Richmond Park	+		1	b	2U
19 71	Richmond Park	+	+	5	b	D,U
19 72	Richmond Park		+	1	b	2U
20 71	Richmond Park	+		1	a	U

Grid Ref.	*Location*	*Visited* *1985*	*1986*	*No. of Visits*	*Max. No. seen*	*Species*
20 73	Richmond Park	+		2	c	P,D
22 72	Barnes, Castlenau	+		1	b	U
22 75	Barnes Common	+		1	a	U
22 77	Barn Elms Reservoirs	+		1	b	U
22 77	Barnes, Castlenau		+	4	b	U
23 76	River Thames	+		1	a	U
15 69	Bushey Park	+		1	a	D
16 69	Bushey Park	+		1	b	P,N
29. SOUTHWARK						
TQ 33 71	Sydenham Hill Golf Club		+	1	a	U
33 71	Great Brownings		+	6	a	U
33 72	Dulwich, College Road	+	+	2	a	U
34 72	Sydenham Hill Woods	+		2	a	P
34 78	Bermondsey, Verney Road	+		1	a	U
35 75	Nunhead Cemetery		+	2	a	P
35 79	Southwark Park	+		1	a	U
30. SUTTON						
TQ 23 63	Nonsuch Park	+		1	a	U
23 65	Worcester Park, Colborn Way	+		1	a	U
24 64	Cheam, Alberta Avenue	+		1	a	U
26 66	Beddington Corner	+		1	a	U
27 66	River Wandle	+		1	a	U
27 66	Mile Bridge Road	+		1	a	U
27 67	River Wandle	+		1	b	U
28 64	Wallington, Manor Road	+		1	a	U
28 64	Carshalton Park	+		1	a	U
28 66	Beddington	+		1	a	U
29 65	Beddington Park	+	+	2	c	P,N,S
31. TOWER HAMLETS						
TQ 35 83	Victoria Park	+		1	b	P,N
35 83	Grand Union Canal		+	1	a	P,N
36 83	Hertford Union Canal		+	1	a	P
36 84	Hertford Union Canal		+	1	a	P
37 82	Bow, Bow Road	+		2	a	U
32. WALTHAM FOREST						
TQ 37 92	Ainslie Wood		+	1	a	U
38 92	Chingford, Lannew Road		+	1	a	U
38 92	Highams Park, Avril Way	+		1	a	U
38 95	Chingford, Yardley Lane		+	1	a	U
39 92	Highams Park		+	1	a	2U
39 94	Warren Pond		+	1	a	U
40 92	Woodford Golf Course		+	1	a	U
34 87	Walthamstow Marsh	+	+	2	b	P
35 86	Walthamstow Marsh		+	1	a	P
39 88	Whipps Cross, Hollow Pond		+	1	b	P,N,D
33. WANDSWORTH						
TQ 22 73	Putney Heath, Scio Pond	+		1	a	U
24 73	Southfields, Skeena Hill		+	1	a	U
27 73	Wandsworth Common	+		2	a	P,N
27 74	Wandsworth Common	+		2	a	U
28 74	Clapham Common	+		1	b	P,N
29 71	Streatham, Penwortham Road	+		1	a	U
29 72	Tooting Bec Common	+		5	a	P,N

FEEDING AREA SURVEY: AREAS OUTSIDE G.L.C. BOUNDARY

Grid Ref.	*Location*	*Visited*		*No. of Visits*	*Max. No. seen*	*Species*
		1985	*1986*			
1. ESSEX						
TL 36 02	River Lea		+	1	–	U
37 01	Horsemill Stream		+	1	–	U
37 01	Old River Lea		+	1	–	U
37 02	Horsemill Stream		+	1	–	2U
37 02	Cornmill Stream		+	1	–	U
44 03	Bury Farm		+	1	c	2U
47 03	Lower Forest Lake		+	1	–	2U
TQ 40 94	Buckhurst Hill, Church Road		+	1	–	U
40 95	Magpie Hill		+	1	–	U
40 95	Connaught Water		+	1	–	P,U
40 96	Fairmead Bottom		+	1	–	U
41 98	Epping Forest Cons. Centre		+	1	–	2U
42 92	M11		+	1	–	U
42 93	Luxborough Lane		+	1	–	2U
42 93	New Barns Lake		+	1	–	U
42 97	Goldings Hill Pond		+	1	–	U
42 97	Baldwins Pond		+	1	–	U
42 97	Blackwater Pond		+	1	–	U
42 98	Goldings Hill Pond		+	1	–	U
42 98	Wake Valley Pond		+	1	–	U
43 95	River Roding		+	1	–	U
43 98	Broadstrood		+	1	–	U
47 94	Lambourne End		+	1	–	U
48 91	Hainault Forest		+	1	–	U
61 91	Thorndon Park		+	1	b	U
62 91	Thorndon Park		+	1	b	U
2. HERTFORDSHIRE						
TL 37 08	Admirals Walk Gravel Pit		+	3	c	P,N,D,S
TQ 03 92	Maple Lodge Cons. Area		+	3	c	P,N,D,S
11 92	South Oxhey, Redwood Close		+	1	–	U
3. SURREY						
TQ 05 73	Staines Reservoirs	+		1	a	U
13 63	Esher, Claremont Gardens		+	1	a	U
13 64	River Mole	+		1	a	P,D
21 61	Epsom, Stones Road		+	1	–	U
22 64	Stoneleigh, Waverley Road		+	1	a	U
12 56	Bookham Common		+	1	a	U
35 51	Godstone, Bay Pond		+	1	a	P,D

APPENDIX 3. Contributors to the Feeding Area Survey, 1985-86.

Dawn Aldridge, Graham Anstey, John Austin, Sue Austin-Burr, David Bale, Clive Banks, Mr N. Barker, Mrs P. J. Bates, Chris Bayley, Kate Beard, Jacqueline Belcher, Phil Belman, Mrs Bernell, Keith Betton, Jane Binstead, Richard Bishop, Nigel Blandford, Neil Bowman, Susan Boyd, Amanda Bracken, Michael Brown, S. N. Burge, Mr Camblin, Mr Care, Christopher Carlisle, Mr Carmichael, Mr Chilton, Michael Clark, Dave Clarke, Mrs Clifford, J. W. G. Cocke, D. A. Coleman, Doug Collins, Lynne Collins, Mr Collins, Alan Cooper, Jeremy Cotton, Paul Darly, Rosa Davis, Dave Dawson, J. De Vries, Mrs Divers, Mr Dobbs, John Dobson, Keith Donolan, Christopher Doyle, Robert Dyson, Peter Edwards, Margaret English, Janet Farrant, Mr Fenner, Nigel Field, Eric Flint, Sue Ford, Maureen Fordham, Ian Friend, P. Gann, Mrs Gawthrop, Marie Gill, Gail Glaser, Mrs Glaves, Richard and Daphne Goulding, R. F. Graham, Malcolm Gray, Frank Greenaway, Mr Griffith, Mrs Griffiths, Anne Groves, Mike Halpin, Mark Hancock, Mr and Mrs V. F. Hancock, J. Hargreaves, Sharon and Tim Harrison, Doug Hawkes, Gavin Hawgood, Mr T. Hawkins, Clive Herbet, Peter Hoffman, Angela Holmes, Mrs Hopwell, Victor Howard, Mrs Howton, Ms Hughes, Mrs Inwood, Mrs Ixer, John James, Richard James, Mrs Virginia

James, Mrs Jarrett, Teresa Jenkins, Geoff Kenton, Ron Kettle, Ricky Kingsley, Ian Kitchen, Tom Langton, Terri Last, James Law, Richard Leighton, James Levy, Mr Lock, Dave Martin, Mr Marton, Jim McClauchlin, A. Merritt, Mr Miller, Peter Mochnaty, Mrs V. M. Moon, Mr W. More, Paul Morgan, David Morris, Jane Neil, Ralph Newton, Angela Norman, George Orway, Mr Pamment, John Park, S. Pearson, Mr Porter, Richard Ranft, Mr Riddle, Fif Robinson, Mr Saunders, E. J. Saunders, Mrs Shaw, Mr Shiffeff, Hugh Shillito, Kathy Sinderson, Ray Softly, Mrs Smith, Gavin Smith, Helen Stanforth, Bob Stebbings, Bob Stratford, Den Sussex, M. Swabey, Shirley Taylor, David Thompson, Judith Thompson, Christine Tirry, Paul Tout, Chris Townsend, A. V. Tucker, J. Tyler, Derek Warren, Barry Watson, Nigel and Nicola Watson, G. Webster, Colin Wheeler, Mrs Whitts, David Williamson, Mr Wilson, Roger Wilson, Jenny Woodman, Richard and Sally Worby.

APPENDIX 4. Example of Feeding Area Survey Form used in 1985-86.

GRID REFERENCE: ☐☐ ☐☐☐ ☐☐☐ ☐ OFFICE USE ONLY

LONDON BAT GROUP
BAT FEEDING AREA SURVEY

BOROUGH:..
LOCATION OF FEEDING AREA: ....
....
....
NAME OF OBSERVER:..
ADDRESS AND TEL No: ....
....
....

(Please sketch map on back of form)

TYPE OF FEEDING AREA:

Deciduous wood ☐
Coniferous wood ☐
Scrub ☐
Uncut grass ☐
Playing fields ☐

Public gardens ☐
Sewage Farm ☐
Cemetery ☐
Railway ☐
Ponds/Lakes ☐

Reservoirs/Gravel pits ☐
Stream/River/Canal ☐
Other (please specify)
....
....

Survey should take place in the period lasting from one hour before to at least one hour after dusk. Record on the sketch map the direction in which the bats were flying.						
RECORDING POINTS (Locate on sketch map)						
DATE						
TIME SPENT:	START					
	FINISH					
NUMBER OF BATS SEEN *						

*a = 0 b = 1 c = 2 to 5 d = 6 to 10 e = 11 to 20 f = 20+

HAVE YOU ANY INFORMATION ON THE SPECIES PRESENT?: ....

....

....

....

WEATHER CONDITIONS AT TIME OF SURVEY: ....

....

....

PLEASE RETURN TO: S. Mickleburgh, Assistant Bat Conservation Officer, Fauna and Flora Preservation Society, c/o Z.S.L., Regents Park, London NW1 4RY.
TELEPHONE: 01-387 9670 01-449 2685 (HOME NUMBER)

Book Review

Breeding Butterflies and Moths: A Practical Handbook for British and European Species. By Ekkehard Friedrich. Translated from the German by Steven Whitebread and edited by A. Maitland Emmet. Harley Books, Colchester. 1986. 176 pp. £20 hardback, ISBN 0 946589 20 8; £9.95 paperback, ISBN 946589 11 9.

The present work is based on the 1983 enlarged and revised German edition which was published originally in 1975 and was followed in 1982 by a French edition. Ekkehard Friedrich was born in Silesia in 1935 and has been an entomologist since boyhood. He started rearing central European Macrolepidoptera over 35 years ago. In the course of this activity he has researched into photo-periodicity as a control mechanism, and some of his results are discussed in the book. He is also an active field entomologist. The translator, Steven Whitebread is an active and well-known British entomologist who for some years has been working and living in Switzerland. He is involved in the study of European Lepidoptera and has considerable experience in their breeding and in the use of artificial diets. The editor is Lt.-Col. A. Maitland Emmet, the distinguished microlepidopterist, well known to many of us in London, and he has contributed an entirely new chapter on the rearing of Microlepidoptera. Other new material includes rearing descriptions of the majority of the British geometrid moths by Jim Reid, a professional entomologist, and a section on artificial or semi-synthetic diets by retired university lecturer Brian Gardiner.

Thus the foregoing credentials make the present edition a highly successful venture which should be in the possession of all serious British students of the Lepidoptera. It is a mine of information.

Following the preliminaries, the text is divided into two parts. Part I, 'Basic Principles', is divided into the following sections: The fundamentals of breeding butterflies and moths; Breeding equipment and techniques, which includes mating, oviposition, and larval rearing; Posting live material; Killing techniques for the collector; The breeder's diary; Conservation; Botanical literature. Part II, 'Rearing Descriptions', is the meat of the book and here one can combine one's own experience of past rearing methods, such as collecting fresh stinging-nettles day after day to feed hordes of ravenous caterpillars (and of becoming immune to the effects of nettles on the hands), or decorating half the trees and shrubs in the garden with sleeves made of muslin, old stockings, or wartime army mosquito netting, or digging pupae at the bases of tree-trunks in the winter months. Many species, however, will not breed easily in captivity unless their exact requirements are met. Despite the natural hardiness of insects it is sometimes very difficult to maintain natural conditions in the house, shed or laboratory and many species succumb to mollycoddling. Naturally, in the wild extremes of humidity (especially the lack of it), predation and parasitism are the enemies of insect larvae and pupae, but nature does manage very well. The hundred and thirteen pages in this section give detailed instructions and numerous hints for rearing about a thousand species of most families occurring in Europe, including 'micros'. The majority of the species descriptions are divided into the following headings: mating, pairing, oviposition, rearing of larvae, overwintering and foodplants.

This is a most welcome addition to any naturalist's bookshelf, but for those seriously rearing Lepidoptera in captivity it will prove a valuable tool and should result in an improved success-rate and perhaps new phenomena being revealed at first hand.

K. H. Hyatt

Some Observations on the Fauna and Flora of Nine Elms, Battersea, before the Development of London's New Covent Garden Market

by W. G. Teagle*

Summary

Three visits were made to the derelict site of British Rail's Nine Elms Depot in the summer of 1970 to record some of its fauna and flora before the area was cleared for the construction of the New Covent Garden Market. A few plant species were found which were not noted elsewhere in tetrad 27T86 during the period 1965-1976 when a survey of the London Area's flora (Burton 1983) was being conducted. The area attracted migratory birds. Several species of Lepidoptera were noted, and other invertebrates included the grasshopper *Chorthippus brunneus* and a then rarely recorded spider, *Tegenaria agrestis*. Spider and other arachnid records are given in full.

Introduction

Nine Elms Goods Depot was situated to the south-west of Vauxhall Bridge, between Nine Elms Lane and Wandsworth Road, S.W.8, at National Grid reference TQ 296772. Most of it lay to the south of the main Southern Region line between the stations Queen's Road (Battersea)† and Vauxhall, with a small area lying to the north of the railway, in the angle formed by the junction of the two roads mentioned above. About 27.5 hectares (68 acres) are now occupied by the New Covent Garden Market, which was officially opened in November 1974. The site is within the Watsonian Vice-county of Surrey (VC17) and in Inner London as it was strictly defined by Holte Macpherson (1929), i.e. a rectangular area with boundaries running four miles east and west and two and a half miles north and south of Charing Cross.

In August 1970, having long been intrigued by the fleeting glimpse one had of this vast wilderness from the windows of the Bournemouth to Waterloo train, I sought permission to examine the area from the Covent Garden Market Authority. Visits were made on 27 and 28 August and 11 September; on the second date I was assisted in the work of recording by my wife, Joyce. Clearance operations had unfortunately begun by 11 September and it became obvious that further visits would not be very profitable.

Nine Elms had been abandoned since 1965 and much of the area had become covered with vegetation. Some of this, to judge from the size of the *Salix* bushes, had become established between the railway sidings before the British Railways Board vacated the depot. The site had already attracted the attention of botanists, but I was not aware of this at the time of my own investigation.

No London naturalist of my generation can look upon a large expanse of urban dereliction without being reminded of the City bombed sites, especially those around the church of St Giles, Cripplegate, which attracted the attention of the Society during the late 1940s and the 1950s. Physically, the Nine Elms site did not bear much resemblance to that scene of war-time devastation. There was no network of streets to divide the area into compact *insulae*, and the place lacked the yawning basements, cross-walls, old churchyards and static water tanks that were important features of Cripplegate. Some buildings still awaited demolition at the eastern end of the Nine Elms site, north of the railway, but most of the area was a dry, flat waste. The main railway line, which crossed it from south-west to north-east, was carried partly on an embankment and partly on a low brick

---

*41 Bell Street, Herston, Swanage, Dorset BH19 2RY.

†Now Queenstown Road.

viaduct with cave-like arches, whereas London Transport's Metropolitan Line crossed the Cripplegate area partly below ground and partly in a cutting. Unlike Cripplegate, Nine Elms was not used as a picnic place for office workers and was thereby denied the innumerable seeds of edible plants that were left as litter on the former site. Nor did its vegetation receive nutrient and additional hayfield species from shovelfuls of horse-dung deposited by street-cleaners, an important biotic factor mentioned by Jones (1958) in his paper on the City bombed sites. Biologically, however, the two localities did have much in common.

There was a pile of dumped earth near one gap in the perimeter fence on the south side and a derelict garden of sorts to the north of the railway, but most of the ground had an artificial surface – the concrete floors of demolished buildings, cobbled roadways, the cindery 'cess' and ballast of old railway tracks and, running parallel to the Southern Region line, an embanked, gravelly area which could have marked the former existence of a siding. The ground was littered with debris of all kinds – slate, bricks, corrugated asbestos, upholstery, plywood, linoleum, metal sheeting, hardboard, concrete panels, railway sleepers and smaller items of local historical significance such as a railwayman's coat and a guard's red flag. These objects provided a refuge for innumerable ground-living invertebrates, especially spiders.

The brief observations of one or two general naturalists over so short a period make a poor contribution to the study of urban ecology, but the Nine Elms site has changed so dramatically since 1970 that there is perhaps some justification for presenting some of them here. They might encourage more intensive studies to be made elsewhere should a similar opportunity arise.

Flora

In his paper on the flora of Central London, Kent (1960) mentioned some of the species occurring at Nine Elms in 1959: traveller's joy *Clematis vitalba,* soapwort *Saponaria officinalis,* lucerne *Medicago sativa* and pot marigold *Calendula officinalis.* The first three were not noticed in 1970, but the *Calendula,* which was growing 'in quantity about railway premises' in 1959, was still present though not common. On 24 September 1966 the site was investigated for the Surrey Flora Committee by Lady Anne Brewis and E. J. Clement, with R. Clarke and Dr D. P. Young, both of whom are now deceased. Lousley (1967), Kent (1967) and Burton (1983) mention their discovery of the bird-seed alien, hairy finger-grass *Digitaria sanguinalis,* and rough bent-grass *Agrostis scabra.* The latter, a North American species, was 'dominant over some 50 yards of trackway' in 1966. It is not mentioned by Hubbard (1968) in his classic book, but is now widespread and fully naturalised in Britain (Clement 1981).

Kent (1967) lists the following species also found in 1966:

Dryopteris dilatata common buckler fern
Rorippa palustris marsh yellow-cress – recorded as *R. islandica*
Erysium cheiranthoides treacle mustard
**Sisymbrium orientale* eastern rocket
**Reseda lutea* mignonette
Spergula arvensis corn spurrey
**Melilotus alba* white melilot
**Lotus corniculatus* common bird's-foot trefoil
**Lathyrus latifolius* broad-leaved everlasting pea
Polygonum amphibium amphibious bistort
Populus tremula aspen – one bush
**Calystegia silvatica* large bindweed
Linaria repens pale toadflax – two or three plants
Artemisia absinthium wormwood – one plant
**Centaurea scabiosa* greater knapweed
Alopecurus myosuroides slender fox-tail

Species marked * were also found in 1970.

I have spared the reader the tedium of persuing the complete catalogue of plants recorded in 1970 (nearly 90 species), for the list made in 1966 is far more comprehensive and was compiled with greater expertise. I have restricted my comments to those species I thought of special interest at the time and those which were evidently not seen on the site or elsewhere in the appropriate tetrad (27T86) during the botanical survey conducted in the Society's Area between 1965 and 1976 (Burton 1983).

Additional species for 27T86 were:
Reseda luteola weld
Ailanthus altissima tree of heaven
Trifolium dubium lesser trefoil
Oenothera sp. evening primrose
Datura stramonium thorn-apple
Verbascum thapsus great mullein
Pulicaria dysenterica common fleabane
Cichorium intybus chicory

and eight or nine escapes from cultivation:
Consolida ambigua larkspur
Althaea rosea hollyhock
Prunus domestica plum
Bilderdykia baldschuanicum Russian vine
Solanum tuberosum potato
Mentha sp. or spp. Possibly two species of mint.
Rudbeckia sp. coneflower
Centaurea cyanus cornflower.

An *Ailanthus* growing under one of the railway arches had reached a height of about 1.35m (4½ft) and there were mature trees of this species close by, beside the railway track. *Prunus domestica* was found near the southern edge of the site, where rubbish of all kinds was thrown over the wall from the neighbouring houses and flats. Other tree species noted were sycamore *Acer pseudoplatanus*, with one specimen growing to a height of 4.5m (15ft), silver birch *Betula pendula (c.* 1m) and a cherry, possibly *Prunus avium* (2m). All these were rare on the site but *Salix* bushes (considered to be *S. caprea*) were of more frequent occurrence and more impressive dimensions. One had achieved a height of *c.* 5.4m (18ft), while another, which was *c.* 2.7m (9ft) high, had spread over an area with a circumference of *c.* 17m (57ft).

The herbaceous plants recorded were, with a few exceptions, those one might normally expect to find on an inland urban waste site in south-east England, and most of them had been noted by Jones (1958) during his survey of the City of London bombed sites in 1952, 1953 and 1955. Wind-dispersed plants were well represented, as were those described by Jones (*op. cit.*) as plants which had a more doubtful means of colonization. There were some species often associated with railways: horse-radish *Armoracia rusticana*, mignonette *Reseda lutea*, bladder campion *Silene vulgaris*, lupin *Lupinus polyphyllus*, broad-leaved everlasting-pea *Lathyrus latifolius*, rosebay willowherb *Chamerion angustifolium*, common toadflax *Linaria vulgaris* and the inevitable Oxford ragwort *Senecio squalidus*. To this list a botanist with more experience would almost certainly have added *Agrostis scabra*. It has been found on railway tracks and sidings at a number of localities besides Nine Elms, at West Hill in south-east Yorkshire, Bordon Camp (Hampshire), Newport Docks (Gwent), Blackheath (south-east London) and at one other Inner London site, a platform at Waterloo Station (Clement 1981).

A single plant of dwarf mallow *Malva neglecta* was perhaps one of the more interesting discoveries made on 27 August 1970. It did not occur on the bombed sites.

Insects

Orthoptera. The common field grasshopper *Chorthippus brunneus* was locally common at several places on the site, both north and south of the railway. The insects were very active in the sunshine on the two August dates. As mentioned by Ragge (1965), this species has a liking for dry, artificial habitats, provided there is grass to feed on, and it is well suited to vegetated urban sites. It was the only grasshopper to occur on the City of London bombed sites (Payne 1958) and was known to be present there from 1946 to 1957. It was recorded at the now defunct William Curtis Ecological Park by Tyler *et al.* (1981) and was still present there in the summer of 1984.

At Nine Elms it occurred in areas colonised by common couch *Elymus repens* and in places where a sward had been formed by an unrecognized bent-grass, possibly the *Agrostis scabra* found by botanists in 1966. It is perhaps worth mentioning that another population of *C. brunneus* was found on 27 August 1970 on a vacant site on the Albert Embankment, S.E.1, between Camelford House and Vauxhall Bridge at TQ 304782.

Dermaptera. The common earwig *Forficula auricularia* was found on *Chamerion angustifolium* on the north side of the railway.

Lepidoptera. The hot and sunny weather on the two August dates encouraged the appearance of butterflies, but on 11 September 1970 the sky was overcast and none was seen. Large whites *Pieris brassicae* were numerous on 27 August and one small white *P. rapae* was noted the following day. Three to four common blues *Polyommatus icarus* were seen on 27 August, one of them frequenting the food plant of the larvae, common bird's-foot-trefoil *Lotus corniculatus,* and three were seen on 28 August. This was the only butterfly seen at Nine Elms that was not on the list of those recorded at Cripplegate by Owen (1952). The small copper *Lycaena phleas* was the only other lycaenid noticed at Nine Elms; one visiting *Senecio squalidus* on 27 August and one to two present on 28 August. A small tortoiseshell *Aglais urticae* was seen on 27 August and four were recorded on 28 August, on which date a single red admiral *Vanessa atalanta* was noted. The butterfly bush *Buddleia davidii,* which has an irresistible attraction for nymphalid species, was only moderately common on the site. The only satyrid observed was the wall brown *Lasiomatta megera,* with four on 27 August and three on 28 August.

Lepidoptera were not collected, and of the moths disturbed from the vegetation only two species were recognized, the large yellow underwing *Noctua pronuba* and the blood-vein *Timandra griseata,* both on 28 August. The latter did not figure on Owen's Cripplegate list, but is extremely common in the London Area (de Worms 1957) and had been recorded in the garden of Buckingham Palace (Bradley and Mere 1964). Some of the food-plants of its larvae, docks *Rumex* spp. and redshank *Polygonum persicaria,* were found at Nine Elms. Caterpillars of the buff-tip *Phalera bucephala* were found on two *Salix* bushes on 27 August, and those of the cinnabar *Tyria jacobaeae* on *Senecio squalidus* on 28 August. These two species were also successful colonists of the Cripplegate sites (Owen *op. cit.*). Other moth larvae were found on all three visits but unfortunately went unidentified.

Diptera: Syrphidae. Three common species of hover-fly were recognized on 27 August: *Scaeva pyrastri, Episyrphus balteatus* and *Eristalis tenax,* all of which occurred at Cripplegate (Parmenter 1954).

Coleoptera: Coccinellidae. The seven-spot ladybird *Coccinella septempunctata* was found on 27 August.

Arachnids

These were the only invertebrates to be collected. The task of identification was kindly undertaken by Dr P. Merrett of the Institute of Terrestrial Ecology at Furzebrook Research Station, Wareham, Dorset.

Spiders have been collected from several parts of Inner London. The City bombed sites at Cripplegate were examined at intervals in 1947 and 1948 by Le Gros (1949) and 20 species were identified. W. S. Bristowe (1964) took part in the biological survey of the garden of Buckingham Palace between 1960 and 1964 (McClintock 1964) and refound all the 26 species he had recorded there in 1929 (Bristowe 1939), plus another 29. He failed, however, to rediscover *Segestria florentina,* which had lived in the garden's bomb-damaged walls between 1946 and 1949. Three of the sites investigated during the 1977 survey of ground-living arthropods of London gardens (Davis 1979) were in Inner London: Pembroke Square (Kensington), Tavistock Place (St Pancras) and the Chelsea Physic Garden. Between them these sites yielded only 12 species, if we ignore a number of unidentifiable immature linyphiids, but only one method of collection was employed, the use of pitfall traps.

Odd spider records for Campden Hill, Hyde Park, Lord's Cricket Ground, New Cross, Paddington, Regent's Park, Tottenham Court Road, the Tower of London, the Minories and Westminster are given by Savory and Le Gros (1957), and Bristowe (1958) mentions the occurrence of three species at the British Museum (Natural History) in South Kensington, which he had himself added to the British list at an earlier date. Two Inner London localities, the British Museum (Natural History) and the garden of Buckingham Palace, are given for one species, *Heterodyctina* (now *Nigma) walckenaeri* in Locket, Millidge and Merrett (1974), and 25 species from the William Curtis Ecological Park were identified in 1980 (Tyler *et al.* 1981). There are no doubt other records scattered throughout the literature; a comprehensive list of the spiders of Inner London has yet to be produced.

The species found at Nine Elms in 1970 are listed below in the order in which they appear in the check list of British spiders published in Locket, Millidge and Merrett (*op. cit.*) and, except in the case of one species of *Tegenaria,* I have used their nomenclature. All references to Cripplegate relate to the 1949 paper by Le Gros, unless otherwise stated, and the 1980 records for the William Curtis Ecological Park are given in Tyler *et al.* (1981). The distribution maps referred to are those in Locket, Millidge and Merrett (*op. cit.*), which show the County of London represented by the old London County Council area.

A few of the Nine Elms specimens were retained at Furzebrook Research Station. The rest were given to J. E. D. Milner, the Society's Recorder of Arachnida, in September 1986.

Amaurobiidae

Amaurobius sp. A juvenile specimen under a railway sleeper, 11 September 1970.

Two species of *Amaurobius* (formerly *Ciniflo*) were found at Cripplegate, *A. similis* and *A. fenestralis. A. similis* is a common inhabitant of walls and outbuildings, and also lurks under stones, etc.

Gnaphosidae

Drassodes sp. An adult found under a piece of linoleum on 11 September 1970 was identified in 1970 as *Drassodes lapidosus* (Walck.) and another *Drassodes* found under a bit of slate on the same date was thought to be of this species. Since 1970 a 'variety' of *D. lapidosus* has been recognized as a separate species, *D. cupreus* (Bl.). The two species, which are not easy to tell apart, have been found together in some types of habitat, and whereas *D. lapidosus* seems the more likely of the two to have occurred at Nine Elms, we shall never know for certain, for the two specimens mentioned above are now in a poor condition and can no longer be critically examined.

Immature specimens of *Drassodes* sp. were found under blocks of concrete and a railwayman's discarded coat on 28 August 1970.

Micaria sp. One under tarpaulin on 27 August 1970.

Micaria pulicaria was found at Cripplegate by P. W. E. Currie (Savory and Le Gros 1957) and the 1974 distribution maps show this to have been the only representative of this genus of ant-like spiders to have been recorded in the old L.C.C. area.

Clubionidae

Clubiona neglecta. One under a piece of card on 27 August 1970.

This species was not listed by Savory and Le Gros (1957) and appears to be a new record for Inner London. Roberts (1985) states that it is fairly widespread and common, frequenting low vegetation in mainly dry habitats.

Thomisidae

Xysticus kochi. Two females, one with an egg sac, under a guard's flag, 28 August 1970 and another under wastepaper on 11 September 1970.

This species was not found at Cripplegate but the 1974 distribution maps show that it had occurred in the L.C.C. area by that date. It was recorded in 1980 at the William Curtis Ecological Park.

Immature crab-spiders of the genus *Xysticus* were found at Nine Elms on the leaves and flowers of great mullein *Verbascum thapsus* and under a tin lid, 27-28 August 1970.

Salticidae

Salticus sp. A juvenile on an evening primrose *Oenothera* sp., 28 August 1970.

S. scenicus, the well-known zebra spider, was noted at Cripplegate and is closely associated with buildings. No other species of *Salticus* is shown to have occurred in the L.C.C. area by the 1974 distribution maps.

Pisauridae

Pisaura mirabilis. The characteristic nursery web-tents of this wolf spider were not seen at Nine Elms, but a juvenile was collected from vegetation (Yorkshire fog *Holcus lanatus* and feverfew *Tanacetum parthenium*) close to the back gardens of houses overlooking the site, 27 August 1970.

This is a very common spider, but one that was not recorded at Cripplegate.

Agelenidae

Tegenaria spp. 'House spiders' of this genus occurred in abundance and were found lurking under almost every kind of object lying on the ground. Three specimens collected on 11 September 1970 from under the rubbish under one of the railway arches were of the very common species, also recorded at Cripplegate, which was known as *Tegenaria atrica* Koch. In recent years the genus *Tegenaria* has been subjected to a good deal of taxonomic revision, and by 1974 *T. atrica* had been reclassified as *T. saeva* Bl., and the specific name *atrica* had been acquired by the spider previously known as *T. larva* Simon, which is widespread in Ireland but uncommon in England. A species with an easterly distribution in Britain was later separated from *T. saeva* and was given the name *T. gigantea* Chamberlin and Ivie.

Two of the three Nine Elms specimens of '*T. atrica*', both of them females, were still in my possession in 1986. They were examined by Mr Milner and found to be *T. gigantea*.

The other specimens of *Tegenaria* were found on both August dates under objects scattered over the open parts of the site, away from the shelter of the railway viaduct. Those collected were found upon examination at Furzebrook Research Station to be *T. agrestis*, a species which, until fairly recently, had been thought to be extremely rare in Britain. A deliberate search was made for this spider on 11 September and more specimens were obtained.

Bristowe (1958) and Locket and Millidge (1953) mention only one record of *T. agrestis,* that of a single specimen found in a gravel pit on Wilverley Plain in the New Forest, Hampshire. By 1970 it was known to be more widespread. *Tegenaria* species have little popular appeal; they are even disliked by some arachnologists. Dr Merrett told me, when examining the Nine Elms specimens in 1970, that *agrestis* was more likely to be collected by people who knew comparatively little about spiders (which was certainly true in my case!) than by more experienced workers. The latter were apt to assume, on seeing a *Tegenaria* in the field, that they were looking at one of the very common species. By the time vol. III of *British Spiders* (Locket, Millidge and Merrett 1974) had appeared, however, *T. agrestis* had been recorded from 13 English counties and waste ground had been recognized as one of its habitats. It was in such a place that I found a specimen in 1975, under the Gravelly Hill motorway interchange ('Spaghetti Junction') in Birmingham (Teagle 1978). Roberts (1985) states that this spider has now been found in Scotland and that it is probably extending its range.

Araneidae

Araneus diadematus. Webs of the familiar garden spider were found on *Chamerion angustifolium* on 27 August 1970 and a male was found on Japanese knotweed *Reynoutria japonica* on 11 September 1970.

This was the only orb-web spinner found at Cripplegate. At the time of the bombed site survey atmospheric pollution was still serious in Inner London, and Le Gros gave this as a possible reason for the scarcity of the members of this group.

Linyphiidae

Only six species of this large family (the 'money-spiders') were found at Cripplegate and these did not include any that were collected at Nine Elms.

Diplocephalus cristatus. One female under upholstery, 27 August 1970.

This species had been found in the Buckingham Palace garden (Bristowe 1939). It was also recorded at two of the Inner London sites investigated by Davis (1979), the Chelsea Physic Garden and the garden of Tavistock Place. It was also amongst the species identified in 1980 from the William Curtis Ecological Park.

Ostearius melanopygius. A female under a piece of cloth and a juvenile under some wood; both on 11 September 1970.

These are apparently the first records of this species for the old County of London, but it has since been recorded at another Inner London site, the Camley Street Nature Park, Camden, as was reported by J. E. D. Milner in the May 1986 issue of the Society's *Newsletter.* Locket and Millidge (1953) state that the species was found in 'a number of English counties' and that it may have been imported from New Zealand. In the third volume of *British Spiders* (1974) they make the comment (with Merrett) that it had been recorded from the south coast of England to Perthshire and that its range was increasing. Like all spiders which disperse by 'ballooning' on a thread of silk, they are likely to appear anywhere. Jones (1983) mentions a number of localities right across the globe where this aeronaut has been recorded.

Lepthyphantes nebulosus. One under a piece of card, 11 September 1970.

No Inner London records are given by Savory and Le Gros (1957), Bristowe (1964), Davis (1979) or Tyler *et al.* (1981), but the species is a widespread inhabitant of buildings and has been noted in other parts of the old County of London.

Linyphia triangularis. A female on its web on Michaelmas daisy *Aster* sp. on 27 August 1970.

Savory and Le Gros (1957) mention a number of localities in the old County of London where this common species has occurred, but there do not seem to be any previous records for Inner London, not even for the garden of Buckingham Palace. The hammock-like webs of this spider are an obvious feature in late summer, especially when covered in morning dew.

The two common species of harvestmen (Opiliones) were collected.

Phalangiidae

Phalangium opilio. One male under a piece of card, 27 August 1970.

This was considered by Savory and Le Gros (1957) to be common all over the Society's Area. This is no doubt its status in Inner London but there is a dearth of published records. It was the only species of harvestman of which adults were collected in the garden of Buckingham Palace (Bristowe 1964).

Opilio parietinus. One under some wood and one under cardboard on 27 August 1970. One under a *Salix* bush on 28 August 1970.

Savory and Le Gros (1957) do not mention any Inner London localities.

Other Invertebrates

Chilopoda: Lithobiidae

Lithobius forficatus. One under cardboard on 27 August 1970 was the only centipede noted.

Isopoda: Oniscidae

Oniscus asellus. This common woodlouse was found under various items of rubbish on 27 August 1970 and 11 September 1970.

Gastropoda: Pulmonata: Limacidae

Netted slug *Deroceras (Agriolimax) reticulatum.* Found under wood on 11 September 1970.

Birds

Like Cripplegate bombed sites, Nine Elms not only provided a feeding ground for local residents but attracted insectivorous species passing through on migration.

Kestrel *Falco tinnunculus.* A male frequenting the site, 27-28 August 1970 and two birds over on 11 September 1970.

Woodpigeon *Columba palumbus.* One on 27 August 1970, five on 28 August 1970 and two on 11 September 1970, all foraging on the site.

Feral rock dove *Columba livia.* Uncounted numbers seen feeding on all three dates. The arches of the railway viaduct provided ideal nesting sites. 'Squeakers' were heard calling on 27 August 1970 and an eggshell was found on 11 September 1970.

Yellow wagtail *Motacilla flava flavissima.* Three frequenting the site on 28 August 1970 and one flying over on 11 September 1970. These would have been birds on autumn passage, but it is worth mentioning that in 1970 two pairs frequented the near-by Thames-side bombed site between Vauxhall Bridge and Camelford House (already mentioned as a locality for *Chorthippus brunneus*) and that one pair is known to have reared young there (Cornelius 1971).

Whinchat *Saxicola rubetra.* One flycatching from tall plants on 27 August 1970.

Wheatear *Oenanthe oenanthe.* Three on 28 August 1970, frequenting the sparsely vegetated areas.

Carrion Crow *Corvus corone.* Two to four haunting the site on all three dates.

Starling *Sturnus vulgaris* } Present in small numbers on all three
House Sparrow *Passer domesticus* } dates, but uncounted.

Goldfinch *Carduelis carduelis.* Three on 28 August 1970.

Acknowledgements

For permission to explore the Nine Elms site I have to thank Mr Gilbert M. Beer, who was, in 1970, the Covent Garden Market Authority's Planning Officer. I am also grateful to Dr Peter Merrett of the Institute of Terrestrial Ecology for identifying the arachnids collected, and Edward Milner for commenting on the section of the paper dealing with this group and for examining the specimens of *Tegenaria gigantea*. I am indebted to Eric Clement for his comments on the botanical section of the paper and for providing further information on *Agrostis scabra*. Lastly, I wish to thank my wife Joyce for her assistance in the field, and Keith Hyatt for his help and encouragement.

References

BRADLEY, J. D. and MERE, R. M. 1964. Lepidoptera. In McCLINTOCK, D. 1964: 55-74.

BRISTOWE, W. S. 1939. *The Comity of Spiders*. Vol. 1. Ray Society, London.

BRISTOWE, W. S. 1958. *The World of Spiders*. Collins, London.

BRISTOWE, W. S. 1964. Araneae (Spiders). In McCLINTOCK, D. 1964: 48-50.

BURTON, R. M. 1983. *Flora of the London Area*. L.N.H.S., London.

CLEMENT, E. J. 1981. Rough bentgrass in Britain. *B.S.B.I. News* **27:** 18-20.

CORNELIUS, L. W. 1971. Yellow wagtails breeding in Inner London. *Lond. Bird Rep*. **35:** 92.

DAVIS, B. N. K. 1979. The ground arthropods of London gardens. *Lond. Nat*. **58:** 15-24.

DE WORMS, C. G. M. 1957. The moths of London and its surroundings. *Lond. Nat*. **36:** 59-99.

HOLTE MACPHERSON, A. 1929. A list of the birds of Inner London. *Brit. Birds* **22:** 222-244.

HUBBARD, C. E. 1968. *Grasses*. 2nd edition. Penguin Books, Harmondsworth.

JONES, A. W. 1958. The flora of the City of London bombed sites. *Lond. Nat*. **37:** 189-210.

JONES, DICK. 1983. *The Country Life Guide to Spiders of Britain and Northern Europe*. Country Life, Feltham.

KENT, D. H. 1960. A contribution to the flora of Central London. *Lond. Nat*. **39:** 41-62.

KENT, D. H. 1967. Additions and corrections to the flora of Central London (3). *Lond. Nat*. **46:** 26-35.

LE GROS, A. E. 1949. Notes on the spiders of the bombed sites. *Lond. Nat*. **28:** 37-39.

LOCKET, G. H. and MILLIDGE, A. F. 1951. *British Spiders* **1.** Ray Society, London.

LOCKET, G. H. and MILLIDGE, A. F. 1953. *British Spiders* **2.** Ray Society, London.

LOCKET, G. H., MILLIDGE, A. F. and MERRETT, P. 1974. *British Spiders* **3.** Ray Society, London.

LOUSLEY, J. E. 1967. Botanical records for 1966. *Lond. Nat*. **46:** 10-14.

McCLINTOCK, D. 1964. (Editor). Natural history of the garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc*. 1963 (2): 1-140.

OWEN, D. F. 1952. The Lepidoptera of Cripplegate. *Lond. Nat*. **31:** 84-88.

PARMENTER, L. 1954. The flies of the Cripplegate bombed site, City of London. *Lond. Nat*. **33:** 88-100.

PAYNE, R. M. 1958. The distribution of grasshoppers and allied insects in the London Area. *Lond. Nat*. **37:** 102-115.

RAGGE, D. R. 1965. *Grasshoppers, Crickets and Cockroaches of the British Isles*. Warne, London.

ROBERTS, M. J. 1985. *The Spiders of Great Britain and Ireland*, **1.** Harley Books, Colchester.

SAVORY, T. H. and LE GROS, A. E. 1957. The Arachnida of London. *Lond. Nat*. **36:** 41-50.

TEAGLE, W. G. 1978. *The Endless Village*. Nature Conservancy Council, Shrewsbury.

TYLER, J. C., EMERY, M., McANDREWS, S. and NICHOLSON, MAX. 1981. Scientific report in *The William Curtis Ecological Park, Fourth Report, 1980-81*. Ecological Parks Trust, London.

A New List of Spiders Found in London*

by J. E. D. MILNER*

Summary

Records of spiders found in the County of London from published and unpublished sources have been put together to make an up-to-date list of species. A total of 219 species have been recorded although several of these spiders have not been seen in recent years.

Nearly 50 species have been added to the London list in the last few years, but this must be due at least in part to an increase in the activity of arachnologists rather than to changes in the fauna. Thirty-one† species are recorded for London for the first time in this paper.

Introduction

I have taken 'London' to refer to the old County of London, as this has been the basis on which spider records have been kept up till now. Although this definition of London has little meaning today administratively, it does define the central area of the conurbation of London rather well. It must coincide very roughly with the area subjected to the most general levels of air-pollution both historically and to the present day.

Figure 1 shows the approximate outline of the County of London, and some of the most important open spaces and semi-natural areas are given.

Spiders in London

It is thirty years since T. H. Savory and A. E. Le Gros published their 'Arachnida of London' in Volume 36 of *The London Naturalist* and since that time there has apparently been relatively little collecting done in the capital and few papers published with the exception of Russell-Smith's (1978) short article about the spiders of Hampstead Heath. Cloudsley-Thompson (1985) recently noted the poor spider fauna of houses in London, and there have been very limited collections made at one or two sites such as the Ecological Parks. The William Curtis Ecological Park by Tower Bridge is now closed pending building development, but when it was open a list of species was made at the Park for a cyclostyled guide, and these records are included below.

When checking Bristowe's (1964) account of the spiders of Buckingham Palace Garden I found that some of his records seem to have been missed by later authors; these records are also included here.

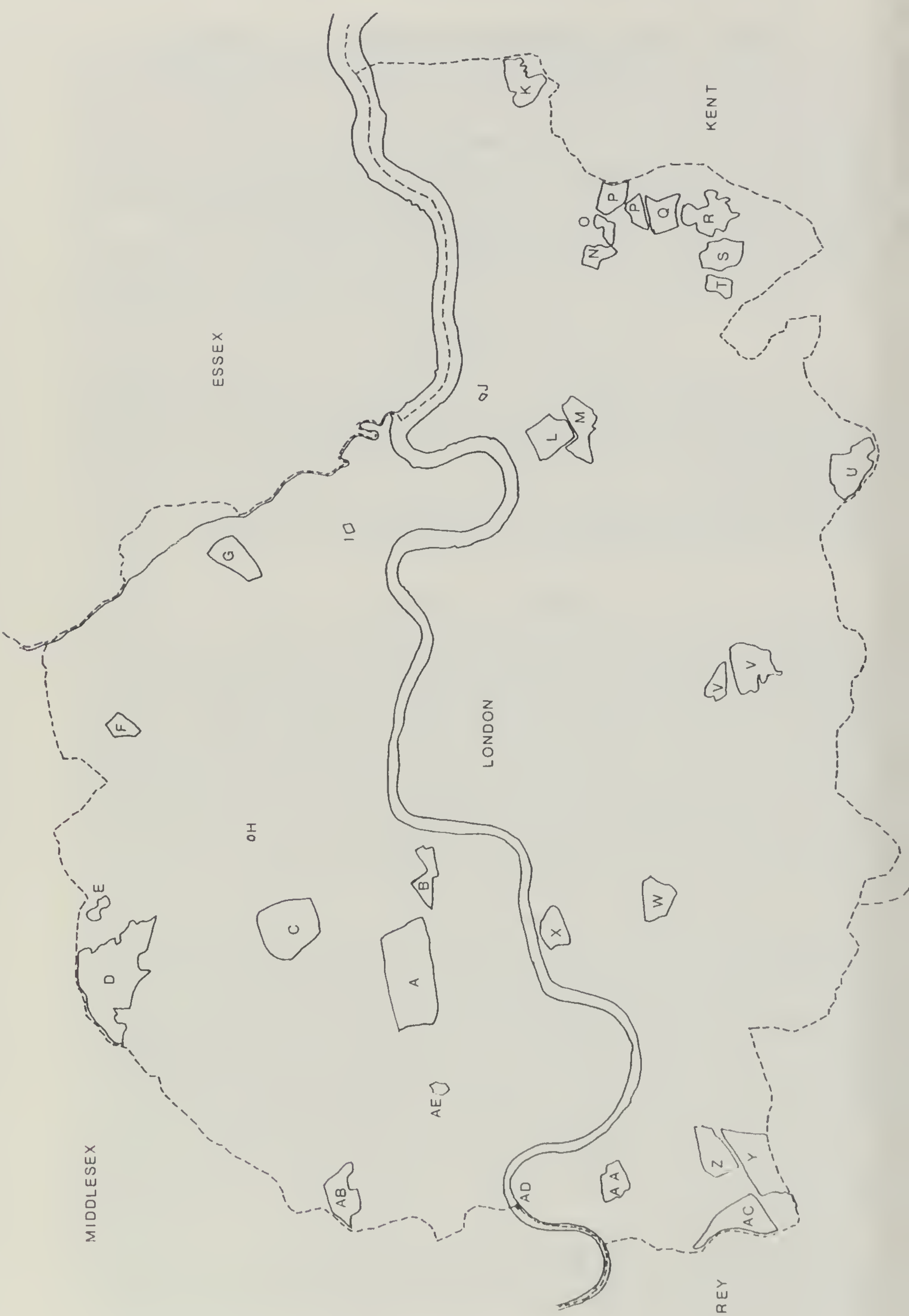
At present there are no sites in the County of London for which a comprehensive list of spiders has been made; even the spider fauna of Hampstead Heath is not very well known and several new London records have been found there in the last few years. Urban Nature Reserves have been set up in a number of places, but thorough investigations of the spider fauna at these sites have yet to be done; since the plant and animal communities are still not fully established the spider faunas can be expected to change over the next few years. Several new London records have already been found at Camley St Nature Reserve.

The list of species recorded for London is continually increasing and can be expected to continue to rise. For example, at least ten further species not listed here are known from sites just outside the boundary of the County of London to the north and east.

Is the spider fauna of London changing? One of the reasons for trying to build up a complete list is so that questions like this can be addressed. The addition of over 50 species to the list in the last few years is misleading; the capital had been

*80 Weston Park, London N8 9TB.

†See Addendum, p. 110.


ESSEX
KENT
LONDON
MIDDLESEX
SURREY
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
P
Q
R
S
T
U
V
V
W
X
Y
Z
AA
AB
AC
AD
AE

largely neglected by arachnologists and indeed *British Spiders* Volume 3 (Locket *et al.* 1974) and Merrett's (1975, 1982) updates list only 156 species for the county. The species which are reported for the first time are denoted by * in the list below.

There are however good reasons to expect that the spider fauna has changed and is continuing to do so. The environment of London suffers less from smoke pollution than in the past, while air-pollution caused by motor vehicles has increased; the effects of these changes can only be guessed at. In some ways London's environment is clearly improving as a habitat for spiders, for example by the increase in semi-natural areas such as the Urban Nature Reserves mentioned above.

The list given below has 219† species, some of which have not been found for many years and they may not still be found in London; some examples are *Araneus marmoreus, Micrommata virescens, Anyphaena accentuata,* and *Diaea dorsata.*

One species recorded by Savory and Le Gros (1957) is not included; *Hasarius adansoni* inhabits hothouses and is not now accepted in the British List (Merrett *op. cit.*). *Erigone vagans* was celebrated by Savory as 'the outstanding London spider' on the basis of records from the Finchley filter beds. This location was to the west of Coppetts Wood in Barnet, Middlesex, according to a personal communication from Mr P. Musgrove of The Finchley Society, and so cannot be considered a London record. However the writer is pleased to be able to retain this unusual species in the London list on the basis of his own record of a single female collected at the Camley St Nature Reserve in September 1986. Identification was confirmed by Dr Peter Merrett.

The nomenclature used below follows Merrett *et al.* (1985). Where species were originally recorded under previously accepted names (by the authors given) these earlier names are included in brackets.

†Including five species noted in the Addendum, p. 110.

KEY TO LETTERS USED IN SPECIES LIST

A Locket *et al.* (1974), Merrett (1975 and 1982).
B Savory and Le Gros (1957).
C Russell-Smith (1978), and pers. comm.; records from Hampstead Heath.
D Bristowe (1964) records from Buckingham Palace Garden.
E Milner records for 1984-1987.
F Ecological Parks Trust (cyclostyled reports and pers. comm.).
G Softly, R. A. (pers. comm.) records from Hampstead Heath 1986.

FIG. 1. Major open spaces in the County of London.

A	*Hyde Park
B	Green Park/St. James's Park
C	*Regent's Park
D	Hampstead Heath
E	Highgate Cemetery
F	*Clissold Park
G	*Victoria Park, Hackney
H	Camley St Nature Reserve
I	Tower Hamlets Cemetery (Nature Reserve)
J	*Greenwich Marshes
K	*Bostall Woods
L	*Greenwich Park
M	*Blackheath
N	*Eltham Common
O	*Jack Wood
P	Oxleas Wood and Shepherdleas Wood
Q	*Eltham Warren (golf course)
R	*Avery Hill
S	*Royal Blackheath Golf Course
T	*Eltham Palace
U	Beckenham Place Park
V	*Dulwich
W	Clapham Common
X	*Battersea Park
Y	Wimbledon Common (part)
Z	Putney Heath
AA	*Barnes Common
AB	*Wormwood Scrubs
AC	Richmond Park (part)
AD	Chiswick Eyot
AE	*Holland Park

* = locations with few records for spiders.

H Murphy, F. M. (pers. comm.) records from Hampstead Heath 1968-9.
I Mohamed, N. (pers. comm.) records from Wandsworth 1986.
J Teagle, W. G. (in press†) records from Nine Elms 1970-1, and Wandsworth 1986.
K Wanless, F. R. (pers. comm. from F. M. Murphy).
L Cloudsley-Thompson (1985) records from Lancaster Gate.
(for G and I identifications have been confirmed by the writer)

*denotes a new record for the County of London.

THE REVISED LIST

(See also Addendum p. 110)

ATYPIDAE		
Atypus affinis[1] (notes below)	A	Hampstead Heath (B)
AMAUROBIIDAE		
Amaurobius fenestralis	A,B,D	Widespread
Amaurobius similis	A,B,C,D	Widespread
Amaurobius ferox	A,B	Widespread
DICTYNIDAE		
Dictyna arundinacea	A,B	
Dictyna uncinata	A,C,D	Hampstead Heath (E) Regent's Park Canal (E) Putney Common (I)
Dictyna latens	A	
Nigma walckenaeri (D. viridissima)	A,D	
OONOPIDAE		
Oonops pulcher	A,B,C,D	Camley St N.R. (E)
Oonops domesticus	A,B,D	Lancaster Gate (L)
DYSDERIDAE		
Dysdera erythrina	B	
Dysdera crocata	A,B	Millwall Dock (E)
Harpactea hombergi	A,B,C,D	Hampstead Heath (E)[5]
SEGESTRIIDAE		
Segestria senoculata	A,B	
Segestria florentina	A,B,D	
SCYTODIDAE		
Scytodes thoracica	A,B	
PHOLCIDAE		
Pholcus phalangioides	A,B,D	
Psilochorus simoni	A,B,D	
GNAPHOSIDAE		
Drassodes lapidosus	A,B,D	Hampstead Heath (G) Nine Elms (J)
Drassodes cupreus	A,B	
Haplodrassus signifer	A,B	
Scotophaeus blackwalli (Herpyllus)	A,B,D	
Zelotes latreillei	A	
Urozelotes rusticus (Zelotes)	A	
Micaria pulicaria	A,B,D	Dockland (E) Highgate Cemetery (E) Wormwood Scrubs (E)

---

†See this issue, p. 95.

CLUBIONIDAE		
Clubiona corticalis	A,B,C,D	Hyde Park (E) Dulwich Upper Wood (F) Oxleas Wood (E)
Clubiona reclusa	A,B,C,D	Hampstead Heath (E)[5]
Clubiona pallidula	A	
**Clubiona phragmitis*		Camley St N.R. (E) Chiswick Eyot (E)
Clubiona terrestris	A	Highgate Cemetery (E) Regent's Park Canal (E) Oxleas Wood (E)
**Clubiona neglecta*		Highgate Cemetery (E) Nine Elms (J)
Clubiona lutescens	A,B,C	Hampstead Heath (G) Camley St N.R. (E)
Clubiona compta	A,B	Oxleas Wood (E)
Clubiona brevipes	D	Hampstead Heath (E) Oxleas Wood (E)
Clubiona trivialis	A,B	
Clubiona diversa	B	
Phrurolithus festivus	B	Regent's Park Canal (E)
Agroeca brunnea	B	
ZORIDAE		
Zora spinimana	A,B,C	Putney Heath (I)
ANYPHAENIDAE		
Anyphaena accentuata	A,B	
EUSPARASSIDAE		
Micrommata virescens[2]	B	Oxleas Wood (E)[4]
THOMISIDAE		
Diaea dorsata[2]	A,B	(Kenwood 1736)
Xysticus cristatus	A,B,C,D	Widespread
Xysticus kochi	A	Wm Curtis Ecological Park (F) Nine Elms (J)
Xysticus erraticus	A,B	
Oxyptila praticola	B,D	
PHILODROMIDAE		
Philodromus aureolus	A,B	Hampstead Heath (E)
Philodromus cespitum	A	Wimbledon Common (I)
Tibellus oblongus	B,D	
SALTICIDAE		
Salticus scenicus	A,B,D	Widespread
Euophrys frontalis	A,B,D	King George's Park Wandsworth (I)
Euophrys aequipes	A,B	Wm Curtis Ecological Park (F)
Euophrys lanigera	A,B	Lancaster Gate (L)
Sitticus pubescens	A,B	
Evarcha falcata	B,D	
LYCOSIDAE		
Pardosa monticola	A,B	
Pardosa palustris (tarsalis)	A,B	Widespread
Pardosa pullata	A,B,C	Widespread
Pardosa prativaga	C	Wm Curtis Ecological Park (F) Dulwich Upper Wood (F)
Pardosa amentata	A,B,C	
Pardosa nigriceps	A	
Pardosa lugubris	A	Oxleas Wood (E)
Alepecosa pulverulenta (Xerolycosa)	A,B	
Alepecosa accentuata (Tarentula barbipes)	A,B	
Trochosa ruricola	A,B	Hampstead Heath (E)

Trochosa terricola	A,B,D	Hampstead Heath (H)
Arctosa perita	A	Wm Curtis Ecological Park (F)
Pirata piraticus	A,B,C,D	Hampstead Heath (E)
PISAURIDAE		
Pisaura mirabilis	A,B	Hampstead Heath (E,G)
AGELENIDAE		
Argyroneta aquatica	B	Wandsworth (I)
Agelena labyrinthica	A,B	
**Tegenaria gigantea*		Millwall Dock (E) Nine Elms (J)
Tegenaria saeva	A	
Tegenaria atrica	B,D	
Tegenaria parietina	A,B	
Tegenaria agrestis	A	Nine Elms (J)
Tegenaria domestica	A,B,D	Widespread
Tegenaria sylvestris	B	Dulwich Upper Wood (F)
**Coelotes terrestris*		Dulwich Upper Wood (F) Oxleas Wood (E)
Cicurina cicur	B	
Antistea elegans	A,C	Hampstead Pond and Heath incl. Westfield Bog (E,H)
**Hahnia helveola*		Oxleas Wood (E)
MIMETIDAE		
Ero furcata	A	Oxleas Wood (E)
**Ero cambridgei*		Hampstead Heath (E)
THERIDIIDAE		
Steatoda bipunctata	A,B,D	
Steatoda grossa (Teutana)	A,B,D	
Archaearanea tepidariorum (Theridion)	A,B,D	
Theridion sisyphium	A,B	
**Theridion pictum*		Highgate Cemetery (E) Tooting Common (I)
Theridion varians	A,B,D	
Theridion melanurum	A,B,C,D	Dulwich Upper Wood (F)
Theridion tinctum	A,B,C	Wimbledon Common (I)
Theridion bimaculatum	A,B,C,D	Highgate Cemetery (E) Dockland (E)
Theridion pallens	A,B,C	Hampstead Heath (H)
Enoplognatha ovata	A,B,C,D	Widespread
**Enoplognatha thoracica*		Oxleas Wood (E)
Robertus lividus	A,C	Hampstead Heath (E) Chiswick Eyot (E) Oxleas Wood (E)
**Pholcomma gibbum*		Oxleas Wood (E)
NESTICIDAE		
Nesticus cellulanus	A,B,D	Dulwich Upper Wood (F)
TETRAGNATHIDAE		
Tetragnatha extensa	A	Chiswick Eyot (E)
Tetragnatha montana	A	
Pachygnatha clercki	A,B,C,D	Hampstead Heath (E) Dockland (E) Chiswick Eyot (E)
Pachygnatha degeeri	A,B,D	Wm Curtis Ecological Park (F) Hampstead Heath (H)
METIDAE		
Metellina segmentata (Meta)	A,B,C,D	Hampstead Heath (E,H)
Metellina mengei (Meta)	A,B,C	Hampstead Heath (H) Oxleas Wood (E)

Metellina merianae (Meta)	A,B	
Zygiella x-notata	A,B,D	Holborn Square (E)
Zygiella atrica	A,B	
ARANEIDAE		
Gibberanea gibbosus (Araneus)	C	
Araneus diadematus	A,B,D	Wandsworth (I) Covent Garden (E)
Araneus quadratus	A	
Araneus marmoreus (pyramidatus)[2]	B	(Kenwood 1736)
Larinioides cornutus (Araneus)	A	
Larinioides sclopetarius (Araneus)	A,B,D	
Nuctunea umbratica (Araneus)	A,B	Wandsworth (J)
Araniella cucurbitina (Araneus)	A,B,C,D	
**Atea sturmi (Araneus)*		Regent's Park Canal (E)
LINYPHIIDAE		
Ceratinella brevipes	A,C	
Walckenaeria acuminata (Walckenaera)	A,C,D	Westfield Bog (E) Oxleas Wood (E)
Walckenaeria antica	A,B,C	Hampstead Heath (E) Camley St N.R. (E) Limehouse Basin (E)
Walckenaeria atrotibialis (melanocephala)	A,C	
Walckenaeria nudipalpis	A,C	Westfield Bog (E) Hampstead Heath (H)
Walckenaeria cuspidata		Westfield Bog (E) Camley St N.R. (E)
'Dicymbium nigrum'[6]	B,C,D	Oxleas Wood (C)
Dicymbium breviseotosum		Hampstead Heath (E)
Entelecara erythropus	A,B,C,D	Highgate Cemetery (E) St James's Park (E)
**Entelecara flavipes*		Wimbledon Common (I)
Gnathonarium dentatum	A,B,C,D	Highgate Cemetery (E) Westfield Bog (E) Hampstead Heath (H) Camley St N.R. (E) Beckenham Place Park (E)
Gongylidium rufipes	A,C	Highgate Cemetery (E) Hampstead Heath (G,E) Regent's Park Canal (E) Dulwich Upper Wood (F) Oxleas Wood (E)
Dismodicus bifrons	A,C	
Hypomma bituberculatum	A,C	
Hypomma cornutum	A	
Gonatium rubens	A	
**Maso sundevalli*		Hampstead Heath (H) Oxleas Wood (E)
'Pocadicnemis pumila'[7]	B,C	Wimbledon Common (I)
Pocadicnemis pumila s.s.		Oxleas Wood (E)
Oedothorax gibbosus[3]	(C)	Hampstead Heath (E)
Oedothorax tuberosus[3]	(C)	Hampstead Heath (E)
Oedothorax fuscus	A,B,C,D	Wm Curtis Ecological Park (F) Camley St N.R. (E) Beckenham Place Park (E)
**Oedothorax agrestis*		Camley St N.R. (E)
Oedothorax retusus	A,B,C,D	Hampstead Heath (E) Camley St N.R. (E) Wm Curtis Ecological Park (F) Beckenham Place Park (E) Oxleas Wood (E)
Oedothorax apicatus	A,B	
Pelecopsis parallela	A,C	
Cnephalocotes obscurus	A,C	

Tiso vagans	A,B,C	Hampstead Heath (E)
**Tapinocyba insecta*		Kenwood (K)
Thyreosthenius parasiticus	A,D	Westfield Bog (E) Tower Hamlets Cemetery (E)
Monocephalus fuscipes	A,C	Westfield Bog (E) Oxleas Wood (E)
Lophomma punctatum	A,C	Westfield Bog (E) Hampstead Heath (H)
Gongylidiellum vivum	A,C	Hampstead Heath (E)
Micrargus herbigradus	C	
Erigonella hiemalis	B	(Hyde Park)
Savignya frontata	A,B,C,D	Beekenham Place Park (E)
Diplocephalus cristatus	A,B,D	Widespread in Central London (E)
Diplocephalus permixtus	A,C	Westfield Bog (E) Duke's Hollows (E) Beekenham Place Park (E)
Diplocephalus latifrons	A,B,C,D	Hampstead Heath (H) Westfield Bog (E) Putney Heath (I) Oxleas Wood (E)
Diplocephalus picinus	A,C	Hampstead Heath (E) Regent's Park Canal (E) St James's Park (E) Oxleas Wood (E) King George's Park Wandsworth (I)
Araeoncus humilis	A,B	
**Lessertia dentichelis*		Greenwich Marshes (E)
**Typhocrestus digitatus*		Hampstead Heath (E)
**Milleriana inerrans*		Hampstead Heath (E) St James's Park (E)
Erigone dentipalpis	A,B,C,D	Widespread
Erigone atra	A,B,C,D	Widespread
Erigone arctica	A,B	(Woolwich Dock)
**Erigone longipalpis*		Chiswick Eyot (E)
**Erigone vagans*		Camley St N.R. (E)
Leptorhoptrum robustum	A,C	Hampstead Pond (E) Beekenham Place Park (E)
**Ostearius melanopygius*		Camley St N.R. (E) Regent's Park Canal (E) Phoenix St Park (E)
**Porrhomma pygmaeum*		Hampstead Heath (E) Oxleas Wood (E)
**Porrhomma campbelli*		Hampstead Heath (E)
Meioneta rurestris	A,B,D	Hampstead Heath (E) Wm Curtis Ecological Park (F) Camley St N.R. (E)
Meioneta mollis	B	
Meioneta saxatilis	A,C	Holland Park (E)
Meioneta beata	A,B,D	Oxleas Wood (E)
Microneta viaria	A,B,C	Hampstead Heath (H) Oxleas Wood (E)
Centromerus sylvaticus	A,C	Westfield Bog (E)
**Centromerus dilutus*		Highgate Cemetery (E) Oxleas Wood (E)
Tallusia experta (Centromerus)	A,C	Hampstead Heath (E) Regent's Park Canal (E) Camley St N.R. (E)
Centromerita bicolor	A,B	Tower Hamlets Cemetery (E) Oxleas Wood (E)
**Centromerita concinna*		Westfield Bog (E)
**Sintula cornigera*		Oxleas Wood (E)
Saaristoa abnormis (Oreonetides)	A,C	
**Macrargus rufus*		Hampstead Heath (E) Oxleas Wood (E)

Bathyphantes approximatus	A,C	Hampstead Heath (E,H)
Bathyphantes gracilis	A,B,C	Widespread
Bathyphantes parvulus	A,C	Westfield Bog (E) Burns Road Open Space Wandsworth (I)
* *Bathyphantes nigrinus*		Hampstead Heath (E)
Kaestneria dorsalis (Bathyphantes)	A	
Kaestneria pullata (Bathyphantes)	A,C	
Diplostyla concolor (Bathyphantes)	A,B,D	Widespread
Poeciloneta globosa	A,B	
Tapinopa longidens	A,B	
Floronia bucculenta	D	
* *Taranucnus setosus*		Highgate Cemetery (E)
Labulla thoracica	A,B	Hampstead Heath (H)
Stemonyphantes lineatus	A,B,C,D	Widespread
Lepthyphantes nebulosus	A,B,C	Camley St N.R. (E) Nine Elms (J)
Lepthyphantes leprosus	A,B,D	Nine Elms (J) Burns Road Open Space Wandsworth (I) Covent Garden (E)
Lepthyphantes minutus	A,B,D	Hampstead Heath (E) Oxleas Wood (E)
Lepthyphantes alacris	A,B	
Lepthyphantes obscurus	A,C	
Lepthyphantes tenuis	A,B,C,D	Widespread
Lepthyphantes zimmermanni	A,B,C,D	Widespread
Lepthyphantes cristatus	A,C	
Lepthyphantes flavipes	A,C	Oxleas Wood (E) Putney Heath (I)
Lepthyphantes ericaeus	A,C	Westfield Bog (E) Wm Curtis Ecological Park (F)
* *Lepthyphantes pallidus*		Oxleas Wood (E)
* *Helophora insignis*	C	Hampstead Heath (E,H) Oxleas Wood (E)
Linyphia triangularis	A,B,C	Hampstead Heath (E) Nine Elms (J)
Linyphia hortensis	A,B,C	Highgate Cemetery (E) Oxleas Wood (E)
Linyphia montana	A,B,C	Widespread
Linyphia clathrata	A,B,C	Hampstead Heath (H) Regent's Park Canal (E)
Linyphia peltata	A,C	Oxleas Wood (E)
Microlinyphia pusilla	A,B	

Notes

1. *Atypus affinis*. In spite of searches by several arachnologists in recent years, this spider does not seem to have been seen in London since Dallas (1937) noted that it was known at Hampstead Heath and Wimbledon Common.
2. Not recorded this century, but see 4 below.
3. Females indistinguishable, recorded as *Oedothorax gibbosus/tuberosus*.
4. Male specimen found July 1987 (E).
5. Also Oxleas Wood 1987 (E).
6. *D. nigrum* and *D. brevisetosum* females are indistinguishable.
7. '*Pocadicnemis pumila*' has now been split into *P. pumila* s.s. and *P. juncea*.

Acknowledgements

I am grateful to J. R. Parker and to Dr P. Merrett for checking and in some cases identifying specimens, and also to the various arachnologists in London who contributed their own records and comments to this list.

References

BRISTOWE, W. S. 1964, In McClintock, D. C., Richards, O. W. and Maxwell Knight. Natural History of the Garden of Buckingham Palace. *Proc. S. Lond. ent. nat. Hist. Soc.* 1963 (2): 48-54.

CLOUDSLEY-THOMPSON, J. 1985. House spiders of inner London. *Newsl. Br. arachnol. Soc.* **44:** 8.

DALLAS, J. E. S. 1937. *Atypus affinis* Eichw. in the London District. *Lond. Nat.* **16:** 24-25.

LOCKET, G. H. and MILLIDGE, A. F. 1951-3. *British Spiders* **1** and **2.** Ray Society, London.

LOCKET, G. H., MILLIDGE, A. F. and MERRETT, P. 1974. *British Spiders* **3.** Ray Society, London.

MERRETT, P. 1975. New County Records of British Spiders. *Bull. Br. arachnol. Soc.* **3:** 140-141.

MERRETT, P. 1982. New County Records of British Spiders. *Bull. Br. arachnol. Soc.* **5:** 332-336.

MERRETT, P., LOCKET, G. H., and MILLIDGE, A. F. 1985. A Checklist of British spiders. *Bull. Br. arachnol. Soc.* **6:** 381-402.

RUSSELL-SMITH, A. 1978. Spiders from Hampstead Heath, London. *Lond. Nat.* **57:** 55-56.

SAVORY, T. H. and LE GROS, A. E. 1957. The Arachnida of London. *Lond. Nat.* **36:** 41-50.

Addendum

Five further species have been added to the list as a result of pitfall trapping at Oxleas Wood during the summer of 1987. These are (Theridiidae) *Anelosimus vittatus, Theridion mystaceum,* and (Linyphiidae) *Walkenaeria furcillata, Lepthyphantes mengei* and *Lepthyphantes tenebricola.*

Book Review

Animal Habitats. Methuen Children's Books in association with Belitha Press. *The Crab on the Seashore,* ISBN 0 416 62400 6; *The Frog in the Pond,* ISBN 0 416 62380 8; *The Rabbit in the Fields,* ISBN 0 416 62390 5; *The Squirrel in the Trees,* ISBN 0 416 62370 0. £4.95 each.

These short books are all written by Jennifer Coldrey and illustrated with coloured photographs by Oxford Scientific Films.

All the books are written very clearly, are most readable and are never dull, although a remarkable amount of information is included. The books describe the habitats, life-history, food, reproduction, defence mechanisms and struggle for survival, which are very clearly explained. *The Crab on the Seashore* deals with crabs generally but the other three books describe, respectively, the common frog, the rabbit, and the grey (and red) squirrels in detail, although they also mention a few other related world species. The very clear diagrams of food-chains and the brief glossary of technical terms are simply explained in each book. As one would expect from Oxford Scientific Films the photographic illustrations are of a high standard of excellence, all in colour, showing much detail and usually also some interesting behaviour of the animal. Any of these books should surely greatly encourage any child developing an interest in natural history.

Geoffrey Beven

Spiders in Alexandra Park 1984-1987

by J. E. D. Milner*

Summary

The spider fauna of Alexandra Park, north London has been studied from mid 1984 to early 1987, including a 12-month period of pitfall-trapping in three habitats: (a) heath grass, (b) damp meadowland with tussocks of *Deschampsia caespitosa* and (c) mixed woodland, ('Heath', 'Tussock' and 'Wood' respectively).

A total of 864 spiders representing 50 species were trapped in three sets of three pitfalls over the 12 months. Two peaks of spider activity were noted: in June and December. Of the species trapped 62% were members of the family Linyphiidae whilst all other families combined made up 38%. Total numbers were more even (see Table 1). The numbers of each species trapped are given according to time of year and the different habitats.

The commonest species in the three habitats were: For 'Heath' *Pardosa pullata* and *Pachygnatha degeeri*, for 'Wood' *Diplostyla concolor, Lepthyphantes zimmermanni*, and for 'Tussock' *Pardosa pullata* and *Trochosa terricola*.

The separation of species at the three sites was very striking. Of the 50 species of spider recorded from the pitfall traps 32 species (64%) were trapped at one site only, 10 species (20%) at two sites, and only eight species (16%) were trapped at all three sites.

A complete list of the 95 species of spider, one species of hymenopterous parasite and two species of pseudoscorpion recorded at Alexandra Park is given, with totals for the spider catches from pitfall traps at the three different sites.

Nine of these spiders are new records for the County of Middlesex, indicated in the species list by N.

Introduction

Alexandra Park (70 hectares) lies on the south and east facing slopes of Muswell Hill in North London, in the Vice-County of Middlesex. The original woodland of an estate of 400 acres was cleared in the 1700s and used as pasture until 1856, when the farmer Thomas Rhodes died. In the 1860s an area coinciding with the present Park was acquired by a group of local councils and since then Alexandra Park has been a public open space. Much of the park is now 'improved' grassland typical of other London parks. It has been grazed by sheep for some periods until about forty years ago, and most of it is now regularly mown by the Parks Department of Haringey Council. Part of the Park used to be a horse-racing track, and there are other areas of rougher grass which are mown annually or less frequently.

According to Bantock (1984) these areas may approximate some of the earlier vegetative cover as 'it is unlikely that the site was ever fully wooded'. Today's mowing effectively prevents the establishment of tree seedlings over much of the Park.

In 1980 an area of a few hectares in the north-east of the Park was designated as a Conservation Area, where mowing was restricted to a single grass sward. A pond was constructed and planted with a limited number of marsh plants such as yellow flag, soft rush, common reed and reed-mace. Also within the designated Area is a small patch (about 2-3 acres) of mixed woodland which includes some full-grown oak, ash and grey poplar trees together with a number of younger trees both of native and introduced species. Much of the wood has a very extensive ground cover of ivy.

The rest of the Conservation Area is covered with a dense meadow vegetation of grasses and tall flowering plants such as common hogweed, bramble scrub and groups of small trees, mostly oak, hawthorn and ash. There is constant public use of the park, although trampling is restricted in the Conservation Area to well-defined (and gravelled) paths through what is otherwise quite dense vegetation. The whole area has a history of considerable disturbance.

---

*80 Weston Park, London N8 9TB.

The purpose of the study was to make a preliminary assessment of the spider fauna of the Park, especially the Conservation Area, and the distribution of spiders in the different habitats available. A long-term study was envisaged from the start so that seasonal changes could be observed. General collecting during the summer of 1984 was succeeded by pitfall trapping, with some searching and sweeping being done less frequently.

Traps were first set in three different habitats in January 1985 and these have been maintained ever since. This paper reports on the observations made from mid-1984 to mid-1986 and the trap collections made from January 1985 to the end of December 1985.

Materials and Methods

Plastic pitfall traps of a standard size (rim diameter 75mm, and depth 105mm) were set in groups of three at three sites. The individual traps were placed approximately 1m apart in a triangular configuration, and a small quantity of killing and preserving fluid was used in the bottom. The fluid consisted of ethylene glycol (commercially available as anti-freeze), with a small amount of formalin and some domestic detergent as a wetting agent.

Samples were taken at 3-4 week intervals during the year and immediately reset. The original fluid was re-used in dry weather, but otherwise the fluid was replaced.

The sites where the pitfalls were set were:

A – 'Heath' (see Plate 1)

This is on a south-east facing slope in one of the least trampled parts of the open grassland in the Park, outside the Conservation Area. The vegetation consists of a fairly dense grass sward (100% vegetative cover, average about 15cm height with individual grass flowering stems to about 60cm), occasionally mown, growing on black peaty soil over clay.

The heath grass *Sieglingia decumbens* has been recorded in this part of the Park, but the commonest grasses present are *Festuca rubra, Trisetum flavescens* and *Rumex acetocella* with patches of *Holcus lanatus, Dactylis glomerata* and *Agrostis stolonifera.*

B – 'Tussock' (see Plate 2)

This site (also in the Conservation Area) is in a densely vegetated meadow area (with 100% ground cover) which is sometimes partly trampled in the summer. The grasses present include large tussocks of *Deschampsia caespitosa.*

The vegetation averages 30-40cm, but there are many taller stems of common hogweed and occasional small oak trees. The site is poorly drained with areas of standing water sometimes occurring in the winter. Other grass species present are *Arrhenatherum elatius, Alopecurus pratensis* and *Poa pratensis,* in addition to all the grasses occurring at the 'Heath' site.

C – 'Wood' (see Plate 3)

This site, within the Conservation Area, is in a relatively undisturbed thicket about 5 metres from a path in a dense part of the mixed woodland. The ground cover of ivy is 100%, and grows to an average height of 25cm at that point.

D – 'Oak' (see Plate 4)

Traps were also set from July onwards at a fourth site 'Oak', but as sampling only began later in the year the totals are not given here. (The species recorded from the 'Oak' traps are included in the species list marked *). The site is on a sparsely

Plate 1. 'Heath' site.

PLATE 2. 'Tussock' site.

PLATE 3. The Wood. Site 'Wood' is about 50 metres beyond the signboard.

PLATE 4. South-east facing slopes of the Park. Site 'Oak' foreground, and 'Heath' on the further stretch of grass.

vegetated grassy area about 50m below the 'Heath' site on the same south-east facing slope, under one of the scattered mature oak trees. The vegetative cover is only about 90% and consists of mosses, and the grasses *Festuca rubra* and *Holcus lanatus*.

Other collecting methods

Hand searches were made during the six months prior to the original setting of the traps, and less frequently at various times during the study period. In dry weather a sweep-net was used and some samples of leaf-litter were sorted. All these methods together were used mainly in the summer months and have continued up to the present time.

Results

A total of 864 adult spiders were trapped in the nine pitfalls (3×3 sites) during the period 1 January 1985 to 29 December 1985. A total of 50 species was represented of which 31 (62%) were Linyphiidae and 19 (38%) were other families (see Table 1). When the catches from the general collecting, and from various pitfalls used outside the study period, are added in a total of 95 species of which 52 (55%) are Linyphiidae.

TABLE 1. Totals of spiders trapped at 3 sites over 12 months.
(*) = No. of species occurring at that site only. L = Linyphiidae.

		Individuals			*Species*		*Linyphiids*	
	L	Non-L	Total	L	Non-L	Total	Nos.	spp.
A Heath	277	301	578	18	10	28(11*)	48%	65%
B Tussock	73	112	185	17	10	27(11*)	39%	63%
C Wood	91	10	101	15	7	22(10*)	91%	68%
Totals	441	423	864	[31]	[21]	[50(32*)]		

The total number of trap-nights (TN) was 3,258 (9 × 362 nights), and as the trapping periods were not always the same the totals for each of the trapping periods 1 to 13 (January to December) are given in Table 2 with corrected figures for 100TN. Even ignoring Period 2 (during much of this period snow covered the traps) the corrected catch varied from 19 in Feb-March to 194 in June (a tenfold increase), while the number of species varied from eight to 22 for the same two periods.

The pitfall trap catches during the study period suggest that there was a main peak of spider activity in early summer, with a secondary peak in December (see Table 2). The number of species found varied less through the year (although the species concerned were often different in different months), and an early summer peak was less noticeable. The January count of 15 species was 68% of the highest (June) count.

TABLE 2. Total catch by sample Jan.–Dec.
*Corrected to 250TN as this is 1/13 of the total number of trap-nights.

	Jan.					*June*						*Dec.*	
Catch No.	1	2	3	4	5	6	7	8	9	10	11	12	13
No. of days (9 traps)	32	27	23	27	35	36	23	42	25	20	15	28	29
Species	15	3	8	14	11	22	19	17	13	11	10	8	8
Total spiders	39	3	16	67	136	252	89	40	37	25	32	30	106
Corrected total (to 250TN)*	34	3	19	69	108	194	107	26	41	35	59	30	102

Variations in the catch for the three sites during the year are given in Figure 1, the very large summer peak for site A – 'Heath' being due almost entirely to the appearance of large numbers of adult lycosid spiders, in particular *Pardosa pullata*. The variation in the species diversity for the three sites is very similar.

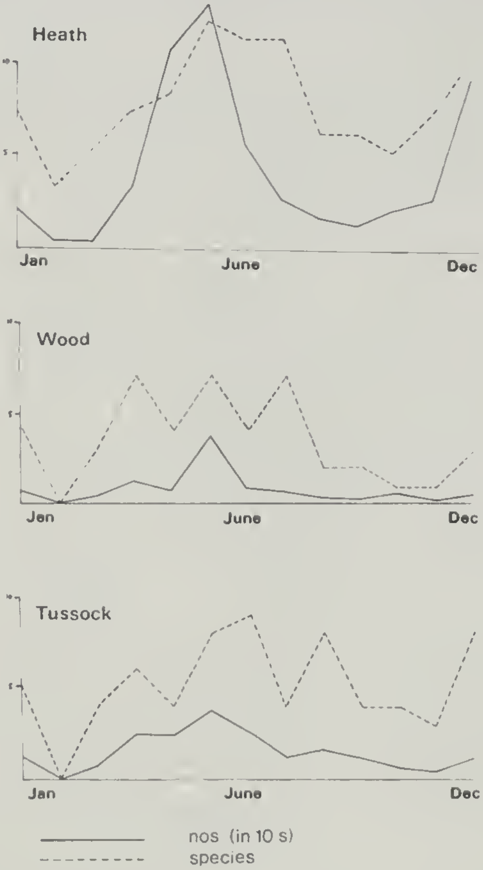


FIG 1. Seasonal variation at three sites.

Table 3 shows the annual variation for selected species (from all sites) which were found to occur fairly commonly. The figures for the four lycosid spiders

TABLE 3. Annual variation in catch of selected species.
* = males present

	Jan.						*June*						*Dec.*
	1	2	3	4	5	6	7	8	9	10	11	12	13
NON-LINYPHIIDAE:													
Pardosa palustris	–	–	–	–	–	34*	–	2	–	–	–	–	–
Pardosa pullata	–	–	–	2*	37*	74*	27*	10	7	2	–	–	–
Alepecosa pulverulenta	–	–	–	–	–	32*	12*	1	–	1	–	–	–
Trochosa terricola	–	–	11*	10*	17*	–	3*	–	6*	1*	–	–	–
Pachygnatha degeeri	–	1	1*	16*	34*	18*	2*	–	6*	5*	4*	2	3*
LINYPHIIDAE:													
Tiso vagans	3*	1*	6*	4*	20*	30*	4	1*	3*	–	4*	2*	1*
Diplocephalus picinus	–	–	–	–	–	17*	2	1	–	–	–	–	–
Centromerita spp.	8*	1*	–	–	–	–	–	–	–	–	1	8*	43*
Meioneta spp.	–	–	–	2*	1*	5*	13*	3	–	–	–	–	–
Bathyphantes gracilis	2*	–	–	–	–	–	–	1	–	–	1	6*	25*
Diplostyla concolor	2	–	7*	2*	4*	12*	2*	2*	2	1	2*	–	3*
Lepthyphantes tenuis	6*	–	–	2*	6*	2	5*	10*	2	3*	10*	4*	19*
Lepthyphantes ericaeus	7*	–	–	–	–	1	3*	–	–	1*	–	4*	1*

Pardosa pullata, P. palustris, Alopecosa pulverulenta and *Trochosa terricola,* as well as *Meioneta* spp. and *Diplocephalus picinus* reveal an exclusive activity in the summer months. (Immature lycosids were trapped at other times sometimes in large numbers, but they are not included in the figures).

Certain other species are clearly active throughout the year. These include *Pachygnatha degeeri. Tiso vagans, Diplostyla concolor* and *Lepthyphantes tenuis.* More surprisingly perhaps a number of spiders were found to be winter-active. The two *Centromerita* spp. were trapped only in the winter; *Bathyphantes gracilis* and *Walckenaeria acuminata,* and two species of *Lepthyphantes (L. tenuis* and *L. ericaeus),* all showed marked peaks in the winter.

Finally Table 4 shows some habitat preferences for those species which are sufficiently common to appear relatively frequently in the traps. As Table 1 indicates, marked habitat preferences were evident from the total of 32 species (64% of the total) which were trapped at one site only: 10 species (20%) were trapped at two sites and only eight species (16%) were recorded from all three sites.

TABLE 4. Habitat preferences for selected species.

	Heath	*Wood*	*Tussock*	*Total*
Xysticus cristatus	18	–	–	18
Pardosa palustris	35	1	–	36
Pardosa pullata	109	–	50	159
Alopecosa pulverulenta	39	–	7	46
Trochosa terricola	6	2	40	48
Pachygnatha degeeri	91	–	1	92
Tiso vagans	79	–	–	79
Diplocephalus picinus	1	19	–	20
Meioneta spp.	23	1	–	24
Centromerita spp.	60	–	1	61
Bathyphantes gracilis	26	3	6	35
Diplostyla concolor	1	26	12	39
Stemonyphantes lineatus	–	–	7	7
Lepthyphantes tenuis	62	5	2	69
Lepthyphantes zimmermanni	4	19	2	25
Lepthyphantes ericaeus	7	–	10	17

These three-site species were: *Trochosa terricola, Walckenaeria cucullata, Micrargus herbigradus, Erigone dentipalpis, Bathyphantes gracilis, Diplostyla concolor, Lepthyphantes tenuis* and *Lepthyphantes zimmermanni,* which are all known as common, widespread species.

The presence of adult male spiders at a particular time of year is taken to indicate that a species is actively breeding. Table 3 gives the periods of male activity for selected species.

The winter-active spiders were all found to be winter-breeding, while two species exhibiting marked summer peaks in numbers trapped were found to be breeding all year. These were: *Pachygnatha degeeri,* and *Tiso vagans.*

Discussion

The gross figures for the pitfalls in this study are depressed by various factors. Since the areas sampled are in a public park it was not thought advisable to put small metal roofs over the traps which would have helped to prevent their filling with snow, dead leaves, rainwater, litter and so on. Occasionally each of these was a problem, as was vandalism by dogs, foxes, children as well as accidental damage caused by mowing machines. The traps were emptied often enough to prevent rotting of the contents but flooding at the 'Tussock' site must have adversely affected the catch once or twice.

Surveys which depend entirely or largely on pitfall-trapping for their field data need to be interpreted with circumspection. It is not clear exactly what fraction of the community is sampled by pitfalls, and it is therefore necessary to use other methods of collection to supplement pitfall data if the intention is to make an assessment of the whole spider community. Pitfalls best sample ground-living spiders, but as Duffey (1972) has pointed out the effectiveness of pitfall traps varies even with these species.

During this study a number of species have been found by searching or sweeping very close to the pitfall traps which have never occurred in the traps. In particular those spiders such as *Meta* spp. and *Linyphia* spp. are common in Alexandra Park but are hardly ever seen in the traps. Other species that live under bark (such as *Harpactea hombergi*) etc., do not appear in the trap results and much more systematic searching using other methods will have to be done before the species list for Alexandra Park could be taken as comprehensive. However, since there are few sites in the London area for which more complete lists have been compiled a list of all the species so far found is given below.

The list of 95 species (55% linyphiids) for the Park represents rather an impoverished fauna as might be expected from the nature and history of the locality. The list includes nine species not previously recorded in Middlesex (marked N in the species list), but none of these is a particularly unusual or rare spider. A revised list from these records together with those given in Locket *et al.* (1974), Merrett (1975, 1982) gives a total for the county of Middlesex of 239 species, of which 97 (41%) are linyphiids.

There are very few sites in Britain where more than 200 species (from a total British fauna of 623 species) have been recorded but intensive study such as that undertaken at Alexandra Park has generally produced longer species lists from similar though less disturbed habitats in other parts of England.

Duffey (1972) reported 141 species (41% linyphiids) from his study of grassland at Wytham Wood in Oxfordshire, and lists of 122 to 205 species for six 'well-worked' sites in southern England. The Bookham Common Survey has produced a list of 202 spiders (Le Gros 1973, Groves 1984) of which 67 (33%) are linyphiids but the Common is mostly a heathland habitat hardly comparable with Alexandra Park. Murphy and Murphy (1973) reported 281 species (40% linyphiids) from another nearby heathland area, Chobham Common in Surrey on the outskirts of London. The list for this locality has now reached over 300 (F. M. Murphy, pers comm).

The relatively high proportion of linyphiids (54%) found at Alexandra Park may be a reflection of the high degree of disturbance. These are small, mostly ground-living spiders which may be less sensitive to trampling, and several of them are known as pioneer species. Several larger species such as orb-web spinners may be deterred by the level of disturbance in the Park.

It is well known that the proportion of linyphiids appears to increase further north and may reach 100% of the catch at some places in Scotland. Duffey (1963) reported 146 species from grassland at Malham Tarn, Yorkshire, of which 72% (105 spp.) were linyphiids, and much further north in the Shetlands the total list of recorded species is only 89 (Locket *et al.* 1974) of which 62 species (70%) are linyphiids.

The total number of species found in the traps in the course of the year was surprisingly low even taking account of the nature of the area and the degree of disturbance suffered. Further observations may reveal additional species in some of the other sub-habitats in the park; several species not found in the traps at the three main sites have been taken in traps at the site referred to as 'Oak', and by searching at other places in the park.

Some very common species, like *Araneus diadematus*, which are known from the surrounding area have yet to be found in the park although they almost certainly occur there. Further searching may well reveal their presence. A number of less common species also occur nearby in similar habitats to those in the park, but have yet to be found there; e.g. *Cicurina cicur*, and *Cnephalocotes obscurus*.

Most of the spiders which were recorded from the pitfalls are very common and widespread, except for two species; *Floronia bucculenta* and *Helophora insignis* which are both relatively uncommon in south-east England.

F. bucculenta is known as a 'marsh' species (Duffey pers. comm.) and was found only at the 'Tussock' site; this may suggest that the site was formerly wetter than it is today. This is very likely as a drainage channel running about 50 metres from the trap site was constructed at the time that the area was being designated as a Conservation Area. *F. bucculenta* is also found in very similar rough grassland prone to winter waterlogging about a mile from Alexandra Park at Crouch End Playing Fields. *Helophora insignis*, which is also known as a 'marsh' species has only been found at the 'Wood' site but it also occurs in damp woodland on Hampstead Heath and at Queen's Wood in Highgate.

The habitat preferences of many spiders are not well understood or even known, but the results of this study show that there are very clear differences in the distribution of most of the species found in the park. The results show that the hunting spiders of the family Lycosidae which were very common during the summer in the grassland, and the crab-spider *Xysticus cristatus*, were nearly absent altogether from the rather dense wood as might be expected.

The pale-coloured linyphiids *Stemonyphantes lineatus* and *Lepthyphantes ericaeus* were found only in the two grassland sites and most of the commonly occurring spiders in the wood were dark-coloured species. *Lepthyphantes tenuis* appears to prefer the grassland sites being more or less replaced by *Lepthyphantes zimmermanni* in the wood. In some cases the tops of the traps were found to have been used as web sites by *Lepthyphantes* spp. in the grassland sites by *L. tenuis* and in the wood by *L. zimmermanni*. (These individuals were included in the trap scores).

Some of the linyphiids found to be winter breeding at Alexandra Park such as *Centromerita* spp., *Bathyphantes gracilis* and *Walckenaeria acuminata*, breed in the summer in the north of England and Scotland. Several small and highly mobile linyphiid species such as *Erigone* spp. *Savignya frontata*, and *Milleriana inerrans* were absent or rare at the three trap sites but have occurred sometimes in large numbers at the 'Oak' site, which seems to suggest a pioneer community. Searches and some pitfall trapping around the pond has produced a very limited number of species, all of them common in the 'Tussock' site with the addition of *Pirata piraticus* and *Gnathonarium dentatum*, both common spiders of other damp places in the district. and also *Leptorhoptrum robustum* which is much less common. These findings are to be expected when it is remembered that the pond was only constructed six years ago; while the spider fauna is still poor, it is interesting to note that the dragonfly fauna is very rich (S. J. Brooks, Dragonfly Recorder, pers. comm.); dragonflies are well known as a successful pioneer group.

Spiders Recorded at Alexandra Park

The figures on the left are for Heath-Wood-Tussock pitfalls.

T = Total for pitfalls. (No figures indicates absence from traps).
* = recorded from Oak pitfalls.
† = recorded from the wet area around the pond.
N = new record for Middlesex county.

Pitfall Catches	*Species*	*Occurrence at Alexandra Park*
	AMAUROBIIDAE	
	Amaurobius similis	
	Amaurobius ferox	uncommon
	DICTYNIDAE	
	Dictyna uncinata	
	Dictyna latens	
	DYSDERIDAE	
	Harpactea hombergi	
	GNAPHOSIDAE	
	Micaria pulicaria	uncommon
	CLUBIONIDAE	
	Clubiona corticalis	under bark
	Clubiona terrestris	
	Clubiona lutescens	uncommon
00–01–00 T01	*Clubiona diversa*	
	THOMISIDAE	
18–00–00 T018	*Xysticus cristatus*	
	PHILODROMIDAE	
	Philodromus cespitum	in long grass
	Tibellus oblongus	in long grass
	SALTICIDAE	
00–00–03 T03	*Euophrys frontalis*	
	LYCOSIDAE	
35–01–00 T36	*Pardosa palustris*	
109–00–50 T159	*Pardosa pullata*	
01–00–00 T01	* *Pardosa amentata*	uncommon
	Pardosa prativaga	uncommon
39–00–07 T46	*Alopecosa pulverulenta*	
01–00–00 T01	*Trochosa ruricola*	
06–02–40 T48	† *Trochosa terricola*	
	† *Pirata piraticus*	around pond
	PISAURIDAE	
00–00–01 T01	*Pisaura mirabilis*	in long grass
	AGELENIDAE	
	Agelena labyrinthica	in long grass
	Tegenaria gigantea	around buildings
00–00–01 T01	*Tegenaria agrestis*	a single specimen
	Coelotes terrestris	on dead wood
	MIMETIDAE	
	Ero cambridgei	uncommon
00–01–00 T01	*Ero furcata*	uncommon
00–00–01 T01	*Ero* sp. indet.	
	THERIDIIDAE	
00–00–01 T01	*Theridion bimaculatum*	
00–01–00 T01	*Enoplognatha ovata*	
02–00–00 T02	N *Enoplognatha thoracica*	uncommon
	N *Enoplognatha oelandica*	a single specimen
	Pholcomma gibbum	wood: a single specimen
	NESTICIDAE	
00–01–00 T01	*Nesticus cellulanus*	uncommon in the wood
	TETRAGNATHIDAE	
	Tetragnatha extensa	uncommon in long grass
01–00–07 T08	*Pachygnatha clercki*	
91–00–01 T92	*Pachygnatha degeeri*	abundant

Pitfall Catches	*Species*	*Occurrence at Alexandra Park*
	METIDAE	
	Metellina segmentata	common
	Metellina mengei	common
00–03–00 T03	*Metellina merianae*	uncommon in the wood
	ARANEIDAE	
	Araneus sclopetarius	a single specimen
	Nuctenea umbratica	on fences around pond
	LINYPHIIDAE	
00–04–00 T04	† *Walckenaeria acuminata*	
02–00–00 T02	*Walckenaeria antica*	
01–01–01 T03	*Walckenaeria cucullata*	
01–00–00 T01	*Walckenaeria atrotibialis*	uncommon
	Walckenaeria unicornis	in grass
00–00–01 T01	*N *Dicymbium brevisetosum*	
00–01–00 T01	† *Gnathonarium dentatum*	
	Dismodicus bifrons	
	Hypomma bituberculatum	in grass
	Maso sundevalli	in leaf litter
00–00–01 T01	N *Pocadicnemis juncea*	
	* *Oedothorax fuscus*	
	* *Oedothorax retusus*	
	Pelecopsis parallela	in grass
79–00–00 T79	* *Tiso vagans*	
	Monocephalus fuscipes	uncommon
	Gongylidiellum vivum	
02–02–05 T09	*Micrargus herbigradus*	
	N *Micrargus apertus*	uncommon
	*N *Micrargus subaequalis*	uncommon
	* *Savignya frontata*	
	Diplocephalus cristatus	
	Diplocephalus latifrons	
01–19–00 T20	*Diplocephalus picinus*	
	* *Milleriana inerrans*	
01–03–02 T06	* *Erigone dentipalpis*	
03–00–00 T03	* *Erigone atra*	
	†N *Leptorhoptrum robustum*	by the pond
00–00–02 T02	*Porrhomma pygmaeum*	uncommon
10–01–00 T11	*Meioneta rurestris*	
	Meioneta saxatilis	uncommon
13–00–00 T13	*Meioneta beata*	common in heathgrass
00–02–00 T02	*Microneta viaria*	common in wood
00–00–04 T04	*Centromerus dilutus*	uncommon
07–00–00 T07	*Centromerita bicolor*	uncommon
53–00–01 T54	*N *Centromerita concinna*	
26–03–06 T35	† *Bathyphantes gracilis*	
02–00–00 T02	†N *Bathyphantes parvulus*	
01–26–12 T39	*Diplostyla concolor*	common in the wood
	Tapinopa longidens	uncommon
00–00–14 T14	*Floronia bucculenta*	only in Tussock area
00–00–07 T07	† *Stemonyphantes lineatus*	Tussock area and pond
	Lepthyphantes minutus	
62–05–02 T69	† *Lepthyphantes tenuis*	
04–19–02 T25	* *Lepthyphantes zimmermanni*	
07–00–10 T17	*Lepthyphantes ericaeus*	
00–01–01 T02	*Lepthyphantes pallidus*	uncommon
00–03–00 T03	*Helophora insignis*	only in the wood
00–01–00 T01	*Linyphia triangularis*	
	Linyphia hortensis	uncommon
00–00–01 T01	*Linyphia montana*	
	Linyphia clathrata	
00–00–01 T01	sp. indet. (rotted)	
578–101–185	Total 864	

Parasite

A hymenopterous parasite larva was found on an adult female *Lepthyphantes tenuis* from a 'Heath' pitfall. It was almost certainly *Acrodactyla degener* (Hymenoptera: Pimplinidae) (M. Shaw pers. comm.).

Pseudoscorpions:

Two species of pseudoscorpion have been found at Alexandra Park, both in pitfall traps:

Chthonius ischnocheles	Heath. July (2 specimens)
Chthonius orthodactylus	Wood. September (1 specimen)

Acknowledgements

I wish to thank John Parker and Dr Peter Merrett for checking and in some cases identifying specimens; Dr Eric Duffey and Prof. John Cloudsley-Thompson for their helpful comments and suggestions; David Bevan for identifying some of the plants, especially the grasses; Dr Gerald Legge who identified the pseudoscorpions; Dr Mark Shaw who identified the parasite; and finally Ken Gay of the Hornsey Historical Society for informing me about the history of Alexandra Park.

References

BANTOCK, C. Undated. *Open Spaces of Haringey*. Cyclostyled report by the Haringey Wildlife Group.

DUFFEY, E. 1963. Ecological studies on the spider fauna of the Malham Tarn area. *Field Studies* **1**(5): 65-87.

DUFFEY, E. 1963. In Steele, R. C. and Welch, R. C. (Eds). *Monk's Wood: a Nature Reserve Record*. Nature Conservancy, Monk's Wood.

DUFFEY, E. 1972. Ecological surveys and the arachnologist. *Bull. Br. arachnol. Soc.* **2**: 69-81.

GROVES, E. W. 1984. *Tetragnatha striata* L. Koch, a spider new to Bookham Common. *Lond. Nat.* **63**: 126-127.

LE GROS, A. E. 1972. The Arachnida of Bookham Common. *Lond. Nat.* **51**: 68-76.

LOCKET, G. H., MILLIDGE, A. F. 1951-3. *British Spiders* **1** and **2**. Ray Society, London.

LOCKET, G. H., MILLIDGE, A. F., and MERRETT, P. 1974. *British Spiders* **3**. Ray Society, London.

MERRETT, P. 1975. New county records of British spiders. *Bull. Br. arachnol. Soc.* **3**: 140-141.

MERRETT, P. 1982. New county records of British spiders. *Bull. Br. arachnol. Soc.* **5**: 332-336.

MERRETT, P., LOCKET, G. H. and MILLIDGE, A. F. 1985. A check-list of British spiders. *Bull. Br. arachnol. Soc.* **6**: 381-402.

MURPHY, J. and MURPHY, F. 1973. The spiders of Chobham Common. *Surrey Nat. Ann. Report*: 23-32.

The Butterflies of London's East End: a Three-Year Survey

by DAVID MURDOCH,* TERRY LYLE** and M. J. G. HOLMES†

Summary

The butterflies of the Inner London Borough of Tower Hamlets were studied between 1984 and 1986, and their distributions mapped on a 1 × 1km square grid. Twenty-two species were recorded, of which 19 were proved to breed. Seven species were recorded from more than 66% of the squares: Essex skipper, large skipper, small white, large white, common blue, small tortoiseshell and meadow brown. Isolated sites smaller than one hectare often supported flourishing populations of several species. We conclude that London's inner city areas can support a wide variety of butterflies if suitable habitat is available.

Introduction

Most British butterflies are declining, largely because of the destruction of their habitats by the activities of man (Heath *et al.* 1984). Natural habitat has been lost partly to agriculture and forestry, but also, and more permanently, to the remorseless expansion of urban areas.

The butterflies of urban environments appear to have been little studied (Plant 1987). A densely populated inner city area, in the East End of London, was surveyed between 1984 and 1986. The objectives were to record the species of butterflies which occurred in the area; to map their distributions; to study their habitat requirements and to produce practical ideas for their conservation.

Study Area and Methods

Description of the Study Area

The Borough of Tower Hamlets is on the north bank of the River Thames (Fig. 1), with the City of London to the west and the Lea Valley to the east. The eastern boundary of the borough runs through the meadows along the River Lea, so the study area was extended slightly to cover the whole of the valley as far north as the Borough of Hackney (Fig. 2). The Surrey Docks, on the south side of the River Thames, lie in a bend of the river which juts into Tower Hamlets; they were included as their butterfly populations might interchange with those on the north bank of the river.

Most of the borough is occupied by terraced housing or by large council estates with high-rise blocks of flats. Gardens, where present, are usually small with few flowers. The parks are almost devoid of wildlife interest. Instead, there are many isolated areas of waste ground, often bombed sites over 40 years old; they are covered with tussocky grasses, particularly cocksfoot *Dactylis glomerata,* and often colonised by buddleia *Buddleia davidii* and a variety of nectar-rich colonists such as black horehound *Ballota nigra* and hawkweeds *Hieracium* spp. There are many patches of brambles *Rubus* spp. and stinging nettles *Urtica dioica.*

Tower Hamlets Cemetery, in the centre of the borough, is the only sizeable area of woodland (eight hectares); it consists mainly of dense self-sown sycamores *Acer pseudoplatanus,* but there are a few glades and a small open nectar-poor area to the north. Some native trees have been planted recently, particularly ash *Fraxinus excelsior* and hawthorn *Crataegus monogyna.*

Along the Thames, the derelict docks (notably Wapping, the Surrey Docks and

---

*1 Porchester House, Varden Street, London E1 2JF
**222 Cable Street, London E1 0BL
†41 Turner Street, London E1 2AV

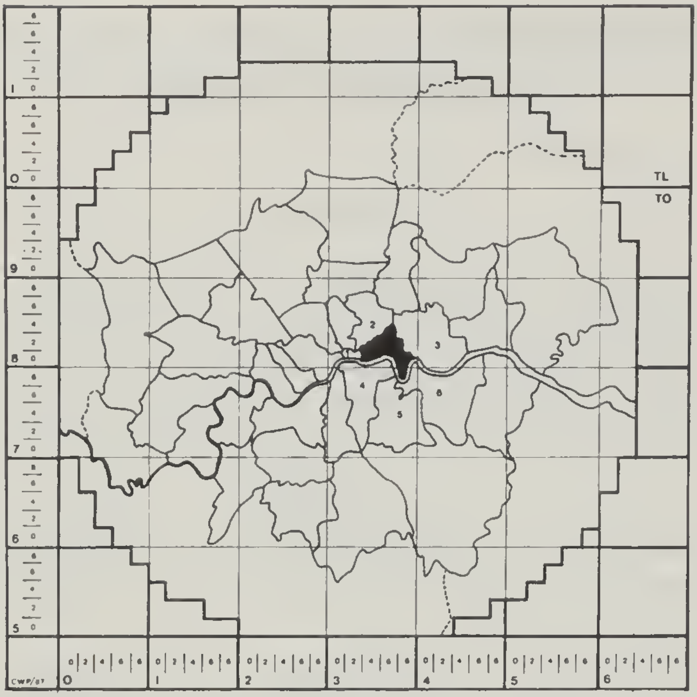


FIG. 1. The London boroughs.

Black area	Tower Hamlets	4	Southwark
1	City of London	5	Lewisham
2	Hackney	6	Greenwich
3	Newham		

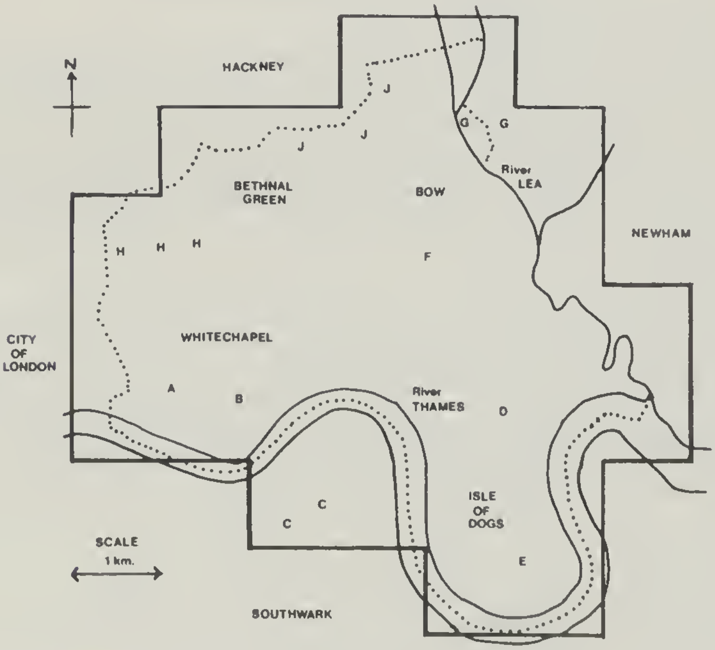


FIG. 2. The survey area.

....	Boundary of Borough of Tower Hamlets	E	Mudchute
A	Royal Mint site (now redeveloped)	F	Tower Hamlets Cemetery
B	Wapping Dock (being redeveloped)	G	Old Ford Lock
C	Surrey Docks (being redeveloped)	H	Bethnal Green Viaduct
D	West India Docks (now redeveloped)	J	Victoria Park

the West India Docks) form a belt of large dry open areas with plenty of butterfly foodplants; however, they are rapidly being redeveloped. The only permanent site is likely to be the Mudchute, a five-hectare area of rough grassland on the Isle of Dogs.

The riverside meadows of the Lea Valley are less likely to be developed, but access is often not possible. The outstanding site is at Old Ford Lock, where a grassy bank, five metres high, covers the 100-year-old Northern Outfall Sewer. A two-hectare triangle of rough, herb-rich grassland (owned by the Thames Water Authority) lies immediately to the north.

Survey Methods

The study area was mapped on a 1 × 1km grid based on the Ordnance Survey system. The following observations were recorded on a standard form at each visit:

date, time and length of visit;
coverage of site;
weather (temperature, cloud cover, wind speed and direction);
and species and numbers of butterflies seen.

Observations were also made of butterfly activities, for instance courtship display; and of the habitats, for instance the availability of nectar.

Results

Weather

The weather greatly influenced the results of this survey. The summers of 1983 (the year before the survey started) and 1984 were hot; butterfly numbers were high. 1985 and 1986 were much cooler, with late springs and cold, wet periods in July and August, separated by brief hot spells in June. By the autumn of 1986, several species, particularly wall brown and small copper, were scarcer than in the autumn of 1984.

Coverage of Survey Area

The survey area was divided into 33 squares of area 1 sq. km. using the Ordnance Survey grid. One square was inaccessible. Four squares were devoid of suitable habitat; they were all visited, and a few wandering butterflies were seen. Seven squares (21%) covering the best sites (Old Ford Lock, the Cemetery, Wapping Docks and the Mudchute) were visited at least 20 times. Of the remaining 21 squares (63%), all were visited on at least two occasions, and all but four at least five times. The survey area was therefore well covered.

Systematic List of the Butterflies

ESSEX SKIPPER *Thymelicus lineola*

Status: Found throughout the study area, often abundant.

This butterfly has a restricted national distribution, but is one of the commonest and most widespread butterflies in the East End: it was recorded from 26 squares out of 33 (78%), and the maximum count was of over 100 (on Bethnal Green Viaduct on 22 July 1984). It is able to colonize any available fragment of wasteland: for instance, a small colony was found on a 50 sq. m. area of roadside grass on the edge of the City. But if there are few sources of nectar for the adults, as in the Cemetery, numbers are low.

SMALL SKIPPER *Thymelicus sylvestris*

Status: Widespread but usually scarce.

Small skippers are found in the same habitats as Essex skippers but, for unknown reasons, they are much less common: the maximum count was of 10-30 (on

Bethnal Green Viaduct on 22 July 1984). They are still widespread; they were recorded from 16 squares (48%), as far west as Wapping Docks (0.5km. from the edge of the City).

LARGE SKIPPER *Ochlodes venata*

Status: Widespread but usually scarce.

Large skippers were found in 24 squares (72%) scattered throughout the East End. Single territorial males were often found on fragments of waste ground, separated from the next by half a mile of housing estate. The largest count was of 30-50 (at Old Ford Lock on 7 July 1984), but numbers are usually lower (below ten), probably because of the males' aggressive behaviour.

LARGE WHITE *Pieris brassicae*

Status: Can be seen anywhere but usually present in small numbers.

Large whites are mobile and conspicuous; as a result, they were recorded from 28 squares out of 33 (84%). However, the breeding population is much smaller than (for instance) Essex skippers or meadow browns, and it is probably heavily influenced by migration. Maximum count 30+ at Old Ford Lock on 13 June 1985.

SMALL WHITE *Pieris rapae*

Status: Appears anywhere, usually common.

Small whites were a familiar sight flying over heavy traffic or through housing estates; they were the most widely recorded butterfly in the survey (30 squares, 90%). Counts of over 30 were common, and over 100 were seen on Bethnal Green Viaduct on 22 July 1984. As with large whites, numbers are heavily influenced by migration.

GREEN-VEINED WHITE *Pieris napi*

Status: Scarce; breeds at three regular sites but wanders widely.

Green-veined whites were seen annually at three sites (Old Ford Lock, the Cemetery and the Mudchute), but not regularly elsewhere. The local foodplants appear to be perennial wallrocket *Diplotaxis tenuifolia* and hedge mustard *Sisymbrium officinale*. Recorded from 12 squares (36%); peak numbers 12 at Old Ford Lock on 19 May 1985.

BRIMSTONE *Gonepteryx rhamni*

Status: Now annual; probably colonising the East End.

Previously recorded only once (in July 1983), adult brimstones were seen three times in 1985-6 (all in the Cemetery). Eggs were found four times (on the Mudchute in 1985 and in Whitechapel in 1986), on bushes of purging buckthorn *Rhamnus cartharticus* planted since 1984. Now that the larval foodplant is present, it will be very interesting to see if brimstones become established in the East End. Recorded from 3 squares (9%).

ORANGE TIP *Anthocharis cardamines*

Status: Not seen every year.

Both recent records are from the Cemetery: three larvae found on garlic mustard on 15 June 1985, and a single male seen flying in mid-May 1986. There may have been a small colony in the Cemetery in the recent past, in which case these records could come from a relict population; or they could be from potential colonists. Seen in only one square (3%).

SMALL COPPER *Lycaena phlaeas*

Status: Rare; Old Ford Lock may now be the only regular site.

A few are seen at Old Ford Lock in most years but the peak count was of only four (on 30 May 1985). A colony on the Mudchute may now be extinct; another in the West India Docks has been destroyed by redevelopment. Otherwise, there are only a few isolated records. Seen in eight squares (24%).

COMMON BLUE *Polyommatus icarus*

Status: Common and widespread throughout the East End.

The larval foodplants, birdsfoot trefoil *Lotus corniculatus* and lucerne *Medicago sativa*, are widespread, and where they are present, there are likely to be common blues; they were recorded from 24 squares (72%) – even from the Royal Mint site by the Tower of London. Several colonies are sizeable, with maximum counts of over 30.

HOLLY BLUE *Celastrina argiolus*

Status: Scarce; three known colonies, but wanders widely.

There are healthy colonies of holly blues in the Cemetery (which has large quantities of ivy *Hedera helix*), and at Old Ford Lock; adults were also seen around holly *Ilex aquifolium* in Victoria Park. On several occasions they were seen flying through built-up areas. Recorded from ten squares (30%) as far west as the edge of the City, with a maximum count of 15 at Old Ford Lock on 29 July 1984.

RED ADMIRAL *Vanessa atalanta*

Status: A scarce but probably under-recorded migrant.

Red admirals only appear in any numbers in late summer and early autumn, after the local buddleias have finished flowering; this may explain why they are never common. Recorded from 12 squares (36%), with a maximum count of seven, at Wapping on 22 September 1985.

PAINTED LADY *Cynthia cardui*

Status: Uncommon migrant.

Another migrant, but not seen every year; most records were from 1985. Recorded from six squares (18%).

SMALL TORTOISESHELL *Aglais urticae*

Status: Occurs throughout the East End, sometimes common.

Small tortoiseshells were not as common or as widespread as expected: counts of more than four were unusual, and they were recorded from only 23 squares (69%) (less than, for instance, large skippers or common blues). The largest count was of over 40 at Wapping on 22 September 1985.

CAMBERWELL BEAUTY *Nymphalis antiopa*

Status: Vagrant; one record.

A single adult was seen by K. Harris on the Mudchute on 18 July 1984. It was watched at a distance of one metre for 15 seconds, while it sunned itself on the front wheel of his bicycle.

PEACOCK *Inachis io*

Status: Rare; no regular breeding sites.

Peacocks are remarkably rare: groups of larvae were found on two occasions, but not more than two adults were ever seen together, and there were no records at all in 1986. Recorded from seven squares (21%).

COMMA *Polygonia c-album*

Status: Widespread but scarce.

Commas were seen in 14 squares (42%) scattered throughout the East End. The maximum count was of five at Wapping on 22 September 1985, but they were usually seen singly. The local foodplants are nettle and hop *Humulus lupulus*.

SPECKLED WOOD *Pararge aegeria*

Status: One tiny colony in the Cemetery and occasional records outside.

The only suitable habitat for this woodland species is in the Cemetery, where it is seen every year in very low numbers; the largest count is of three in July 1984. Two singletons were seen outside the Cemetery in 1986. Recorded from three squares (9%).

WALL BROWN *Lasiommata megera*

Status: Widespread but at present in low numbers.

Plenty of suitable habitat exists for wall browns in the East End, and they breed as far west as Wapping Docks. Colonies are usually small; the maximum count was of 20 on 16 August 1984 in the West India Docks. Recorded from 13 squares (39%), but this is almost certainly an underestimate – very few were seen in the summer of 1986.

MEADOW BROWN *Maniola jurtina*

Status: Found throughout the East End; often abundant.

The meadow brown is the commonest butterfly in the East End – over 100 were counted at several sites, and well over 300 were seen at Old Ford Lock on 7 July 1984. It is very widespread, and can be found on any piece of wasteland, however small. Recorded from 29 squares out of 33 (87%).

GATEKEEPER *Pyronia tithonus*

Status: Vagrant.

Three records: one in Whitechapel on 23 July 1984
one in the Cemetery on 16 July 1986
four on brambles by the River Lea on 14 July 1986.

Gatekeepers are rare and have never been proved to breed in the East End. Apparently suitable habitat does exist, for instance in the Lea Valley.

SMALL HEATH *Coenonympha pamphilus*

Status: Rare; three colonies still survive, one is extinct.

Small heaths now appear to breed only at Old Ford Lock and at two sites that are about to be redeveloped (the Surrey Docks and Marshgate Lane). A colony in the West India Docks has already been destroyed. Surviving colonies are all sizeable (with maximum counts of more than 20), but none was seen elsewhere; it was found in only five squares (15%). Plenty of other apparently suitable habitat exists, for instance in Wapping Docks, but has not been colonized.

The relative abundance of the species, together with details of their range and the numbers counted, may be summarized as follows:

Species	*Number of squares with records*	*Peak adult count*
Very common and widespread:		
Small white	30	>100
Meadow brown	29	>300
Large white	28	30+
Essex skipper	26	>100
Large skipper	24	30–50
Common blue	24	30+
Small tortoiseshell	23	> 40
Scarce but still widespread:		
Small skipper	16	10–30
Comma	14	5
Wall brown	13	20
Green-veined white	12	12
Red admiral	12	7
Holly blue	10	15
Rare:		
Small copper	8	4
Peacock	7	2
Painted lady	6	1
Small heath	5	> 20
Speckled wood	3	3
Brimstone	3	2
Gatekeeper	2	4
Orange tip	1	1
Camberwell beauty	1	1

Discussion

Twenty-two species of butterfly were recorded in the Tower Hamlets between 1984 and 1986. Seven species were recorded in more than two-thirds of the one kilometre squares, and 19 were proved to breed – more than 30% of the regularly breeding British species. A wide variety of butterflies is found in London's East End, and many are flourishing.

The two factors which we suggest determine their status are their habitat requirements and their ability to colonise those habitats.

Habitat requirements

Adequate supplies of larval foodplants, followed by sources of nectar for the adults, appear to be the critical requirements.

Six species require coarse grasses in open situations; of these, meadow browns and two of the three skippers are common and widespread. Small skippers are much less common than Essex skippers, though they are found in similar habitats. Wall browns are also scarce, but there has been a nationwide decrease associated with two poor summers. Small heaths are rare although there is much apparently suitable habitat.

Three species of whites feeding on Cruciferae and five nymphalids feeding chiefly on stinging nettle are highly mobile and well adapted to finding their foodplants on derelict land. Most are common and widespread, but the peacock is rare.

Four species of butterfly have more restricted foodplants. Common blues (birdsfoot trefoil and lucerne) and holly blues (ivy and holly) are both widespread and successful. Brimstones have bred in the last two seasons, with the planting of purging buckthorn, but small coppers, which feed principally on sorrel, appear to be decreasing; the poor weather of the last two years may be partly responsible, but so may the disappearance of warm, dry dockland habitats.

Two woodland species, the speckled wood and orange tip, breed only in the Cemetery, which is probably the only suitable habitat in the survey area.

Peacocks and gatekeepers are rarer than might be expected. Both use nectar sources (buddleia and bramble respectively) which appear to flower earlier in the East End than in the surrounding countryside, and which have nearly finished when these butterflies appear. We do not offer this as a full explanation for the rarity of these butterflies, but it is a line of enquiry that would be worth exploring.

Dispersal and colonization

Much has been made of the importance of 'green corridors' for urban wildlife (Baines 1986). The Lea Valley and the Northern Outfall Sewer (which runs from the Lea Valley east to Beckton) are very important for the eastern half of the survey area, but most of the butterfly sites in the western half are completely isolated; butterflies must fly through built-up areas to reach them.

Many of the wasteland sites are smaller than one hectare, and support tiny populations of skippers, common blues and meadow browns. In isolation, these could not be viable in the long term; butterflies must be regularly moving from one microcolony to the next, over the traffic and through the housing estates. Individuals of at least ten species were seen moving between sites. The more conspicuous, such as whites and holly blues, were noted regularly, but there were also records of such supposedly sedentary species as small coppers, large skippers, wall browns and speckled woods.

The brimstone is known to be a mobile species, and it was first recorded breeding soon after buckthorn bushes were planted. The gatekeeper records suggest that it also might breed if conditions were suitable. In contrast, the rarity of the small heath might be explained if it was less able to colonise suitable, but isolated, sites. Four sizeable colonies were found during the survey, but it was not seen outside them. The dry, open areas on which it breeds are prime targets for redevelopment, and soon it may be found only at Old Ford Lock.

If a species can become established, there are advantages to living in London. The mean temperature is slightly higher than in the surrounding countryside, and this effect is magnified by the arid, stony nature of many wasteland sites, with their suntraps and brick walls. Insecticides are used less than in intensively managed farmland.

Several continental species have been seen in the East End, for the Thames can act as a migration route for butterflies as well as for birds (Heath *et al.* 1984, Plant 1984). Several clouded yellows *Colias croceus* were seen in 1983, and presumed vagrants have included long-tailed blue *Lampides boeticus* in 1980, swallowtail *Papilio machaon* in 1982 and the 1984 Camberwell beauty (Plant 1986).

Conservation proposals

The East End is at the moment a relatively butterfly-rich area; however, large areas of wasteland (especially in Dockland) are in the process of being redeveloped. If the 1980s are not to be a brief but happy interlude before we return to a butterfly desert, butterflies will have to be more actively encouraged.

Rough grassland and nettlebeds are fairly common, but more of the scarcer larval foodplants such as garlic mustard and purging buckthorn need to be planted. Sources of nectar for the adults are often inadequate, particularly in early spring; it is important to plan for a succession of nectar sources throughout the season (Oates 1985). Active management may be necessary, for instance, cutting back vegetation to prevent the shading out of the more valuable plants (Rothschild and Farrell 1983).

In particular, the parks must be more sympathetically managed – at the moment, they fully deserve their colloquial title 'green deserts'. Victoria Park is a huge area with considerable potential, but regular mowing has made it of no interest whatsoever (except for a colony of holly blues). If even small areas could be set aside as 'wildlife oases', they would be of great benefit for butterflies, as well as of educational value for local children.

The Cemetery can also be greatly improved. The clearings in its centre have become overgrown with Japanese knotweed *Polygonum cuspidatum*, and the open area to the north has very few sources of nectar. Simple habitat management should encourage the development of healthy colonies of speckled woods and orange tips. With its wide variety of woodland birds, the Cemetery would be a good candidate for an urban nature reserve.

Old Ford Lock is the most important site in the East End. It has been undisturbed for many years, and its rich flora, large butterfly populations and position for migrant birds, make it the most interesting in the survey area. This site deserves full protection.

Butterfly conservation is of considerable educational potential, and the interest generated can be harnessed to the advantage of wildlife more generally. There has been a welcome trend recently to set up nature gardens in schools. East End children have little contact with wildlife, and a 'butterfly garden' is a valuable way to stimulate their interest.

However, we believe that East End butterflies are of more than only local interest. We have found that supposedly sedentary species, for instance large skippers and common blues, are well able to colonize distant sites; this is presumably true in the countryside as well, but it might be more easily studied in the East End. Essex skippers are locally abundant, but small skippers are scarce: the opposite is true nationally, and their ecological requirements are not understood. More generally, this survey shows that many butterflies are more resilient and adaptable than we have come to believe.

Acknowledgements

We are very grateful to Colin Plant, Matthew Oates and Paul Thompson for reading and criticizing earlier drafts of this paper; to Colin for his map of the London area (Fig. 1); and especially to Ken Harris and J. H. Birch for their valuable records.

References

BAINES, C. 1986. *The Wild Side of Town*. B.B.C. Publications, London.

HEATH, J., POLLARD, E. and THOMAS, J. A. 1984. *The Atlas of Butterflies in Britain and Ireland*. Viking, Harmondsworth.

OATES, M. 1985. *Garden Plants for Butterflies*. Brian Masterton and Associates, Fareham, Hants.

PLANT, C. W. 1984. The clouded yellow butterfly *Colias croceus* Geoffroy in the London area in 1983. *Lond. Nat.* **63:** 94-96.

PLANT, C. W. 1986. Migratory Lepidoptera in the London area. *Lond. Nat.* **65:** 7-30.

PLANT, C. W. 1987. *Butterflies of the London Area*. L.N.H.S., London.

ROTHSCHILD, M. and FARRELL, C. 1983. *The Butterfly Gardener*. Michael Joseph, London.

Book Reviews

A Manual of Forensic Entomology. By K. G. V. Smith. British Museum (Natural History), London. 1986. 205 pp. £17.50. ISBN 0 565 00990 7.

Ken Smith is known to many of us and he has lectured to the Society on more than one occasion. Those who have attended his lectures will be aware of the enthusiasm of his presentation and of his humour. Despite the serious title of the present volume, Ken's enthusiasm is apparent in its pages. The study of the entomology of the cadaver is a very wide-ranging topic. The recognition of the insects, and other invertebrates, feeding on a corpse, together with a knowledge of their life-history, can give a fair indication of the time of death which is of great importance often in murder cases. This is the first book in English to deal exclusively with forensic entomology and is presented in a masterly, readable and engrossing way.

The book commences with a discussion on the faunal succession on cadavers in various situations – exposed, buried, immersed in water, mummification, burnt bodies, their geographical location, temperature and humidity, light and shade, seasonal and daily periodicity, etc. This is followed by a summary of methods and techniques used, collecting equipment, procedure on site and in the laboratory, interpretation of data, experimental work, life-histories and identification. Next are some nineteen case-histories – 'The baby in the box', 'The child behind the stove', 'The two murdered hitchhiking girls', 'The body in the bed', 'The case of the blood-stained shirt' – real Sherlock Holmes and Agatha Christie. The biology and ecology of the insects involved is outlined and where known the rates of development are given over their geographic range. Keys to adult and immature stages are illustrated with over 400 figures and the biliography runs to 17 pages. A must for all serious students of natural history and good bedtime reading.

K. H. Hyatt

City Safari: Wildlife in London. By Gavin Weightman and Mike Birkhead. Sidgwick and Jackson, London. 1986. 175 pp. £13.95 (hardback), ISBN 0 283 99322 7. £9.95 (paperback), ISBN 0 283 99323 5.

Wild in London. David Goode. Michael Joseph, London. 1986. 186 pp. £8.95 (paperback), ISBN 0 7181 2729 1. £14.95 (hardback), ISBN 0 7181 2518 5.

These two books have a great deal in common, besides being the best books on general natural history in London for forty years. They were published within a month of each other, just too late to be reviewed in last year's *London Naturalist*. Their format is very similar, paperback with a coloured photograph on the cover and many more inside. Goode's is the classier production. All the authors have spent time to good effect looking out of their high office windows a few hundred yards apart. They cover a lot of the same ground and may even have bumped into each other while at work; the photograph of a badger in each book has the same honey sandwiches. Both books are based ultimately on their authors' personal experiences, which explains the more striking differences, for whereas Weightman and Birkhead were journeying in London collecting material for a London Weekend Television series, Goode was the Greater London Council's senior ecologist for the four years from the creation of his post to the abolition of his employer. The content of *City Safari* is very different from that of its authors' six half-hour programmes. However if they mention a place in any detail, like Buckingham Palace gardens or the Limmo Peninsula (which they mis-place by Barking Creek) then they took or considered taking their cameras there. A place mentioned in *Wild in London* is more likely to be a good or representative example of its habitat. Goode attempts to be reasonably comprehensive in his discussion of habitat types, but has nothing on swans, muntjac deer or Thames fish. Weightman and Birkhead, on the other hand, have almost nothing corresponding to Goode's account of what he calls 'a green renaissance' and manage to mention the London Wildlife Trust only once. Their discussions of particularly urban aspects of natural history, such as the success of the fox, are on the whole rather more insightful than Goode's. *Wild in London* is slightly larger and cheaper than *City Safari* but will get out of date more quickly as habitats change. Both are excellent value and warmly recommended.

R. M. Burton

A Review of the Lepidoptera of the London Area for 1985 and 1986

by COLIN W. PLANT*

Introduction

The format of this review follows that of earlier years – a convenient division into the three separate groupings of butterflies, Microlepidoptera and Macrolepidoptera. Within these artificial divisions the butterflies are treated in systematic order, whilst the moths are dealt with under the various vice-county headings. Since the atlas of London's butterflies is due to appear in print at roughly the same time as this review article, only the most important records for this group are given here.

Possibly the most important factor governing the appearance of butterflies and moths during the two-year period under review was the weather. During both years the spring was particularly cool, 1985 being generally cooler and wetter than 1986. Extremely detailed notes on the weather during the latter year have been sent to me by Mr A. Vickery of Higham's Park, Essex. At this locality he reports rain on a total of 203 days, sleet or snow on 33, leaving only 129 dry days. Frost was noted on six days in January, and 22 in February – the coldest February since 1947 apparently. August was the coldest since 1963, and one of the wettest on record, with rain on 20 of the 31 days. The Bishop's Stortford Natural History Society recorded 28 inches of rain during the year, as compared to an annual average of 24 inches in that area. Apparently, most of that water came down in August! At East Ham there was a frost almost every night of the year up to 21 April. As a result of the general weather conditions a number of Lepidoptera suffered greatly delayed emergence dates, with 1985 up to three weeks behind and the following year generally four to six weeks later than usual for many species. An early grey *Xylocampa areola* was captured in north London at the end of June 1986, whilst at the same period hebrew characters *Orthosia gothica* were still on the wing. A single clouded drab *O. incerta* was noted also in the same period, and other examples are given in the body of this review. Numbers too were affected, and many species, particularly amongst the butterflies, were very much down in terms of population strength. Common blues *Polyommatus icarus* were something of a rarity during 1986, having had a poor year in 1985 as well, and small coppers *Lycaena phlaeas* too were not plentiful in either year. Small heaths *Coenonympha pamphilus* were practically absent. Notwithstanding this however, the number of species apparently was not affected, and a number of quite noteworthy insects were reported. The following table, kindly provided by Paul Sokoloff and relating to the trap in his garden at Orpington, endorses these points:

Year	*Number of moths*	*Number of species*
1981	12,879	225
1982	14,492	249
1983	13,571	258
1984	16,078	300
1985	12,557	269
1986	12,607	263

Immigrant Lepidoptera were scarce during 1985, with only twelve notable records: A single striped hawk *Hyles lineata livornica* was found dead at Beckenham, Kent in April; during July there were single large tortoiseshells *Nymphalis polychloros* at Wanstead in South Essex and Rickmansworth in Hertfordshire; a four-spotted footman *Lithosia quadra* was taken at Broxbourne,

---

*Passmore Edwards Museum, Romford Road, Stratford, London E15 4LZ
Address for records: 14 West Road, Bishop's Stortford, Hertfordshire CM23 3QP.

Hertfordshire in July; a small mottled willow *Spodoptera exique* was taken at South Croydon, Surrey and another at Rainham, South Essex; a humming-bird hawk *Macroglossum stellatarum* was seen at Bushey in Hertfordshire; three vestals *Rhodometra sacraria* were taken during September at Reigate, Surrey, Hampstead Garden Suburb, Middlesex and Orpington, Kent; and a single white speck *Mythimna unipuncta* was captured at Erith, Kent during July with another at Wimbledon, Surrey in October. Among the commoner species red admirals *Vanessa atalanta* and painted ladies *Cynthia cardui* were scarce, and lower than usual numbers of silver-Y *Autographa gamma* were reported. The dark sword grass *Agrotis ipsillon* was also down in numbers and there were no records at all of the pearly underwing *Peridromia saucia*. During 1986 there were even less immigrants. A humming-bird hawk was seen in a garden at Woodford in South Essex during July with a second at Orpington, Kent in the same month, whilst a third was noted at Uxbridge, Middlesex in June and a fourth at West Wickham, Kent in September. The bordered straw *Heliothis peltigera* was taken in East Ham, South Essex, also during July, and at Orpington in September. Again there were lower than usual numbers of dark sword grass and pearly underwing, although the silver-Y was common. A record of the beautiful snout *Hypena crassalis* at Orpington during July may have related to an immigrant example. No notable immigrant butterflies were reported, and the numbers of red admirals and painted ladies were again lower than in other years.

As far as the resident populations are concerned, a few species are worth singling out at this point. During the earlier year the red-belted clearwing *Synanthedon myopaeformis*, the black arches *Lymantria monacha* and the annulet *Gnophos obscuratus* were recorded for the first time in the Inner London area, whilst in Surrey we have only the third London record of the Kent black arches *Meganola albula* and in Middlesex the second London area record of the marsh pug *Eupithecia pygmaeata*, last reported in 1955. Amongst the micros, *Athrips rancidella*, taken at West Wickham, Kent, was probably the most noteworthy, being a new moth to Britain. Other particularly notable micros include *Bucculatrix thoracella*, *Phaulernis dentella* and *Ethmia funerella*, all in South Essex.

Once again, a few brief comments on published works on Lepidoptera are appropriate. Two identification guides are worthy of note: 1985 saw the appearance of the fourth volume (actually volume 2) of *The Moths and Butterflies of Great Britain and Ireland* edited by A. M. Emmet and J. Heath (Harley Books, Colchester). This volume covers the families Cossidae to Heliodinidae, and so includes the burnets and the clearwings as well as many micros. Particularly useful is the inclusion of a key to gracillariid leaf mines, which will hopefully stimulate some staunch 'macro-only' lepidopterists to start recording interesting micros such as *Phyllonorycter* spp. The second identification guide is *British Pyralid Moths*, written by Barry Goater, and also published by Harley during 1986. The design is essentially the same as that of Bernard Skinner's excellent book mentioned in my last review (Plant 1985), and included are colour photographs of all the British species in nine plates. Many of these species are known in Britain only from the London area.

Of more local interest is the work by Emmet, Pyman and Corke on *The Larger Moths and Butterflies of Essex*, published by the Essex Field Club during 1985 as number 8 in the New Series of *The Essex Naturalist*. During my review of 1983/84 (Plant 1985), I mentioned the publication *The Smaller Moths of Essex* from the same stable, stating that 'this is by far the best local list for any area bordering the London area, and is particularly important since such a large portion of the L.N.H.S. recording circle is included'. I now happily repeat those comments word for word in my description of this companion volume, and I recommend it to all readers interested in the butterflies and larger moths of the London area.

Finally, before moving on to look at the insects themselves, mention must be made of the survey of Surrey Macrolepidoptera, launched in 1985 by Mr G. A. Collins and Mr R. K. Morris. The aim of the survey is to establish the distribution, together with the status, foodplants and habits of all the Macrolepidoptera in the county of Surrey, including that portion which overlaps into the L.N.H.S. recording circle. It is hoped to publish the results in as full a form as possible around 1990. Those who have submitted records to me for the London portion of Surrey may rest assured that there is a full two-way exchange of data between the two schemes, but do please send in records from other parts of the county direct to the organisers, or through me if more convenient.

Corrections to Review of 1983/84

The following important corrections should be made to the review on the pages indicated in *The London Naturalist* **64** (1985):

p. 58 The 1983 records of *Philudoria potatoria, Laspeyria flexula* and *Miltochrista miniata* noted by Mr J. King were from Broxbourne Heath, Herts, and not from his Potters Bar garden as stated.

Mr King's 1984 record of *Miltochrista miniata* should be deleted.

The remaining three species under the Potters Bar heading should correctly be placed in the report on Middlesex (V.C. 21), and the author apologises for making the same mistake which he himself had already corrected for the previous review on page 45 of the review currently discussed!

p. 50 *Acrocercops brongniardella* from Ashtead, 12 July 1983. Lt Col. Emmet has kindly informed me that the Ashtead colony of this species was first noted in 1973 when he found vacated mines. He subsequently reared adults in 1974, some of which were exhibited at the British Entomological and Natural History Society meeting of 9 January 1975.

for '*Glyphipteryx lineella*' read '*Glyphipteryx linneella*'. The record of this species is not the first for Essex, having been discovered at this site in the 1970s by Dr Norman Lowe, and previously at Brentwood (1886), Mucking (1918) and Stanford-le-Hope (1971) by others.

p. 51 On line three, for '*obitella*' read '*oblitella*'. This species was first noted in the county in 1956.

p. 54 Mr B. K. West's garden is more correctly in Dartford, and not in Bexley as stated.

p. 62 For 'Oakland Wood' read 'Oakend Wood'.

BUTTERFLIES

Silver-spotted skippers *Hesperia comma* were noted at Box Hill (A. Merritt), Buckland Hills (D. A. Coleman) and Juniper Hill (A. Merritt) during 1985, and at Brockham Quarry and Hills (D. A. Coleman) and Juniper Top (R. B. Hastings) during 1986. This nationally rare butterfly is now known from five tetrads in the London area. The number of sites for the dingy skipper *Erynnis tages* has almost trebled from twelve to thirty-one tetrads during the two years, a function of improved recording rather than an increase in the insect itself, which remains local. The number of grizzled skipper *Pyrgus malvae* sites rose too from eighteen to thirty-three.

Of the lycaenids, eight new localities were noted for the green hairstreak *Callophrys rubi,* in spite of which there remains still only about thirty known localities in the London area to date. The brown hairstreak *Thecla betulae* was again noted at its Epping Forest site, but more importantly a singleton was seen on Wimbledon Common during 1986 by Ron Kettle, a most exciting discovery bringing the total reported sites for London to three. The white-letter hairstreak *Strymonidia w-album* has clearly recovered from its recent decline, at least in the west of our area, and is beginning to re-appear in some of its former haunts. At the time of writing we have twenty-one known colonies within twenty miles of St Paul's Cathedral. Larvae have now been found repeatedly on the suckers sprouting from the root systems of dead or felled elm trees. Two apparently completely new sites are reported in the north-west of the area by Dr A. M. George who beat larvae from *Ulmus glabra* at both sites and also from *U. procera* at one of them.

A single female small blue *Cupido minimus* was noted amongst grasses at Cuddington Wayside, Surrey by Tony Hare on 19 June 1985, and at least twenty were seen by him during July at Hutchinson's Bank in Kent. This latter locality is one of only two colonies in the Kent part of our area, although there are a further fourteen sites in Surrey and two more in the northern part of our area. A small colony of brown argus *Aricia agestis* at Stanstead Abbots Gravel Pit in Hertfordshire was discovered by Mr G. White during 1985. In spite of its apparent isolation (all of the remaining nineteen colonies in the London area are in Kent and Surrey), the insect apparently persists here in reasonable numbers. The silver-studded blue *Plebejus argus*, though common in parts of Surrey, was thought to be extinct in the London area at the start of 1985, the two known post-1979 sites for this species apparently no longer suitable for its survival. It was immensely pleasurable therefore to receive a communication from Mr A. B. Petrie indicating the presence of a small colony at a new site near Fairmile Common during 1986. Sadly the site is scheduled for conversion to a car park unless very rapid action is taken (January 1987). Another exciting discovery was that of a probable adonis blue *Lysandra bellargus* at Happy Valley in Surrey by Malcolm Jennings, the Surrey Wildlife Trust's District Officer for Croydon, who writes 'I am virtually sure I saw one flying with the chalk-hill blues'. Inevitably, it could not be re-located upon return with the camera!

The white admiral *Ladoga camilla* continues its spread, appearing in a number of new areas, including a wood in North Essex, a wood near the centre of Orpington (P. Sokoloff) and an un-confirmed sighting on the east side of Wimbledon Common (per D. R. Drakeford). This species was also seen at Bookham Common where a purple emperor *Apatura iris* was also seen on 14 July 1985 by D. A. and P. C. Boyd. 1985 was poor for immigrants, and very few red admirals *Vanessa atalanta* or painted ladies *Cynthia cardui* were noted. During 1986 things were a little improved for the common immigrants, with two rather early *atalanta* on 8 and 11 March at Hanwell, Middlesex (P. J. Edwards). A single large tortoiseshell *Nymphalis polychloros* was reported in Wanstead Park, South Essex on 14 July 1985 (N. Mallett), and another was noted at Scotts Hill, Rickmansworth in Hertfordshire on 21 July 1985 by Mr J. E. Anderson. A late peacock *Inachis io* was noted at Moor Lane by Mr J. Goad, when one flew into his house via an open window on 9 December 1985. This was put out on to jasmine flowers in the garden the next day.

A reliable report of dark green fritillary *Argynnis aglaja* heralds from Farthing Downs, on two dates during August 1985 (A. and O. Hall; A. S. Wheeler), whilst on Wimbledon Common one was seen in a clearing near 'Caesar's Well' flying high at the edge of the wood and swooping down on to thistles. There was a second possible sighting a week later (D. R. Drakeford). The rather more widespread silver-washed fritillary *Argynnis paphia* was seen at Happy Valley, Box Hill (P. Harvey), at Bushey, Hertfordshire (Briggs family per B. Sawford), and at West Wickham, Kent, where one was seen feeding on buddleia in a garden.

The London butterfly fauna therefore now stands at 47 species, including immigrants, recorded since the start of 1980, out of a total British fauna of 67, excluding extinct species or those of dubious status.

MICROLEPIDOPTERA

Inner London

I have been reminded that our Inner London area, a precisely defined area measuring some 12 × 8 kilometres, covers parts of two vice-county areas, and it is pointed out that lumping all Inner London area records under one heading precludes addition of the records to vice-county lists. Accordingly therefore, in future I shall endeavour to remember to separate the two vice-comital areas within this general heading as follows:

1. Inner London (Middlesex V.C. 21)

The Camley Street Nature Park near to King's Cross Station lies in what can best be described as one of London's ecological disaster areas, yet not withstanding this, two visits by Ray Softly on 13 and 21 August 1985 produced nine species of micro. The mugwort *Artemisia vulgaris* feeders *Dichrorampha simpliciana* and *Ostrinia nubilalis* are two widespread and common species in the London area, and though how far in to the centre of the Metropolis they penetrate is unclear, they certainly reach Camley Street. Similar comments may be made about the cochylid *Agapeta hamana*, a thistle feeder, and the common brown plume *Emmelina monodactyla* which feeds on various bindweed species. Of more interest is the presence of *Epinotia nisella* whose larvae feed on the catkins of *Salix* in the spring giving rise to adults in June and July. Both the gelechiid *Bryotropha domestica* and the oecophorid *Hoffmannophila pseudospretella* are widespread and abundant in the urban area, the former feeding on mosses – the latter on just about anything! Both were recorded at Camley Street by Mr Softly. Another species noted was *Caloptilia stigmatella* whose tiny larvae mine the leaves of *Salix* or *Populus* (more rarely *Betula*); Its range too is unknown in the truly urban area. Finally, Mr Softly reports the tortricoid *Argyrotaenia pulchellana:* although preferring *Erica, Calluna, Myrica* or *Vaccinium* as a larval pabulum, it can also be widely polyphagous, a fact which may explain its presence in Kings Cross! Sadly, for us at least, Ray Softly embarked upon a tour of the world during 1986, terminating, temporarily, in Australia, and accordingly there is a gap in our records from Inner London during that year.

A. pulchellana also turned up at Fulham where Mr Jeremy Burge took one in his Robinson trap on the night of 19/20 May 1985. This moth clearly had a good year in 1985, (see also under East Ham in the section on South Essex). Other moths noted by Mr Burge at Fulham included *Agonopteryx subpropinquella,* noted for the first time on 15 April 1985, whilst during the following year nine 'new' species included *Aleimma loeflingiana* on 4 July, *Monopis laevigella* on 10 June, *Capua vulgana* on 20 July and *Eudemis profundana* on 9 August. The gelechiid *Oegoconia caradjai* was noted on 14 July.

A stroll along the Queen's Walk in Green Park on 13 October 1986, prior to an L.N.H.S. meeting revealed a number of mines on the vegetation here. The Walk is bounded on one side by a beech *Fagus* hedge, no more than four feet in height, and here almost every leaf had a mine of *Phyllonorycter maestingella* – indeed some leaves had two or three mines, and the species is clearly abundant here. Whilst many of the mines had been vacated, several had fresh puparia protruding from them, far too fresh to have remained here undamaged since August, when typically the second brood emerges. It is debatable whether this implies a third brood here in the slightly warmer central London zone, or whether this merely represents a delayed emergence of the second brood, perhaps resulting from a delay of the first brood earlier in the year. Other *Phyllonorycter* mines included *P. oxyacanthae* on a tree which Rodney Burton assures me is a *Crataegus* of some kind, though it bears no apparent resemblance to our two British species, and *P. massaniella* on *Quercus*. Mines of other genera included *Stigmella oxyacanthella, Lyonetia clerkella* – which seems to have had a good year everywhere in London, more or less monopolising the leaves of the cherry trees *Prunus* spp. and

Caloptilia syringella – which surely must be present wherever there is a moderate sized privet *Ligustrum* sp. bush.

At Covent Garden during 1984, prior to the period currently under review, Mr R. T. Lowe found several pupae and adults of the tortricoid moth *Archips semiferanus* (Walker) associated with *Asparagus plumosa* imported from Florida, U.S.A. This is a new species for Britain, but clearly one imported with the asparagus.

The only other Inner London record of any interest north of the Thames seems to be that of *Plodia interpunctella*, the Indian meal moth, of which a single imago was foolhardy enough to fly across the packed-out meeting room at the Alpine Club in Mayfair, during a meeting of the British Entomological and Natural History Society there on 26 September 1985!

2. Inner London (Surrey V.C. 17)

No records have been received for micros in this part of the Inner London area during 1985-86.

V.C. 16, West Kent

During 1985 Paul Sokoloff noted a reduction in both numbers and species over the previous year at his light trap near Orpington. The pyralid *Pyralis farinalis*, known colloquially as the meal moth, was noted on 30 June and is a species seldom encountered in the Orpington area. It is associated with barns and similar buildings where it feeds on stored cereals and cereal refuse. Nearly a month later on 26 July, an example of the delicate pink coloured *Celypha roseana* was captured – a new record for the Orpington area of what is generally a fairly widespread, albeit local, moth in southern England. The larvae feed on the roots of *Sonchus* and *Taraxacum*. Another newcomer to the area was the European corn-borer *Ostrinia nubilalis* which was attracted to light on 28 August. This is a former immigrant from abroad where it is a serious pest of cereals. In Britain however, it appears to have established itself on *Artemisia vulgaris* since the mid-1930s and is now quite frequent in much of the area adjacent to the River Thames, but clearly it has not made much progress southwards from here. During 1986, large numbers of the very local tortricoid *Dichrorampha consortana* were seen flying in hot sunshine at Saltbox Hill, near to Biggin Hill during June. It is pleasing to record such a local moth in large numbers.

Mr Michael Chalmers-Hunt has sent me a most impressive list of his captures for the period under review, *Athrips rancidella* was frequent in the moth trap at West Wickham during July of both years. At the time of writing this species is not yet recorded from elsewhere in Britain. (An account of its capture is given by Chalmers-Hunt in *Entomologist's Rec. J. var.* **97**: 20-24). It has been taken here regularly since 7 July 1971. At the same locality *Caloptilia azaleella* came to light once during each year, on 10 September 1985 and 23 June 1986 – singletons on each occasion, whilst *Psoricoptera gibbosella* was similarly taken on the first-mentioned date. During 1985 *Olindia scumacherana* was flying and settling in profusion on herbage in the afternoon sunshine of 3 and 4 July along a short stretch of footpath along the northern edge of Westerham Wood. Seventy-five were boxed easily on 4 July and examined for variation prior to release; there were probably between 100 and 200 insects present in total. Other notables during 1986 included *Morophaga choragella* at West Wickham on 11 July; two examples of *Gypsonoma oppressana* on *Populus* trunks at Bexley on 21 July; *Agriphilia selasella* at West Wickham on 10 August and *Zelleria hepariella* at m.v. light at West Wickham on 14 August. Larvae of *Sitochroa palealis* were found on *Daucus carota* at Dartford in September (exhibited at the 1986 joint meeting of L.N.H.S. with B.E.N.H.S. at the Linnean Society's rooms on 11 September 1986). Other larvae found during the earlier year included *Ancylis achatana* on *Cotoneaster horizontalis* during April – a previously un-recorded foodplant and *Teleiodes* *vulgella,* also on the same species of again previously un-recorded foodplant during May.

V.C. 17 Surrey

A total of thirty-six species of Microlepidoptera was recorded during the week 19-26 July 1985 at the Juniper Hall Field Study Centre and reported to me by Ray Softly. Of seventeen pyralids, the most notable was *Catoptria falsella,* a rather rare and local species whose larvae feed on *Tortula* and possibly other genera of mosses. *Evergestis pallidata* is another uncommon species captured here although it is spreading rapidly in the London area, the larvae feeding on wintercress *Barbarea vulgaris.* Amongst the tortricoids, *Agapeta zoegana* is far less frequently reported than *Agapeta hamana,* and both these species were noted here.

A larval caes of *Psyche betulina* was found at Oxshott on 24 April 1985 by Mr N. F. Heal, (exhibited at B.E.N.H.S. annual exhibition 1985).

In spite of the intensive surveys by this Society, relatively little work seems to have been done on the Microlepidoptera of Bookham Common since A. E. Le Gros published a working list in 1977 (*Lond. Nat.* **56:** 77-81). A visit there on 28 September 1985 by the writer produced nine nepticulids, five *Phyllonorycter* spp., *Parornix finitimella, Lyonetia clerkella,* and adults of *Anthophila fabriciana* and *Hoffmannophila pseudospretella.* None of these is particularly noteworthy, indeed they are all common – yet fifteen of these eighteen insects were apparently new to Bookham Common!

Dulwich Upper Wood in the Borough of Southwark is only just within the Surrey boundary, and is surrounded by an urban habitat. It is administered by the Trust for Urban Ecology (formerly Ecological Parks Trust), and at the invitation of Jane Madden, the present Warden there, I ran a light-trap once during each of the two years under review. A large number of moths were noted, the most interesting being *Bucculatrix thoracella,* a seldom recorded insect in our area which also turned up in South Essex during 1986. Other micros here included *Pammene fasciana,* a species less than common in the capital, *Blastobasis decolorella, Epinotia nisella* f. *decorana* Hb. and *Teleiodes luculella.*

V.C. 18 South Essex

Lt Col. A. M. Emmet discovered the epermeniid *Phaulernis dentella* at Grays Chalk Quarry on 29 June 1985. This constitutes a new Essex record, and it is of interest that outside our area Col. Emmet found the moth at Ashdon in the North Essex vice-county a few days later on 30 June. The larvae feed on the seeds of *Chaerophyllum temulentum, Pimpinella* or *Aegopodium.*

At Wanstead Park on 2 August 1985 by far the most abundant moth at dusk was the pyrale *Evergestis pallidata,* already mentioned briefly under the Surrey heading. Selected clumps of bramble and grasses produced several dozens of insects. Another species disturbed at dusk on the same trip was *Ypsolopha sylvella,* a rather pretty oak feeder not recorded from the park before, and one which is uncommon at least in the eastern sector of our area. At light later on, the pine feeder *Catoptria pinella* was noted, along with *Pediasia contaminella,* whilst *Cataclysta lemnata* was also taken in moderation at the sheet.

At my (now former) garden in East Ham, 1985 started slowly, with the first micro of the year a single *Agonopteryx alstroemeriana* which emerged from hibernation on 3 April; this normally appears in early March here, and its delayed awakening is, of course, a result of the cold wet weather which prevailed through the spring. Two new micros were added to the list for the garden during 1985; *Cedestis gysseleniella* was noted on the night of 30/31 June, the first warm humid night of the year here. This is a moth whose larvae are supposed to be exclusively limited to Scots pine *Pinus sylvestris,* and this foodplant does not grow in the immediate neighbourhood. The continued presence of other pine feeders such as

Catoptria pinella perhaps indicates an alternative species of *Pinus?* Similarly *Lozotaeniodes formosanus* (a larch *Larix* feeder) which I take annually – this year on 4 July – is another insect whose presence on a regular basis warrants closer examination. The second new species was the common *Aglossa pinquinalis* which my wife boxed at rest on the kitchen wall on 13 July, and which also appeared again the following year. Larvae of the momphid *Limnaecia phragmitella* feed in the seed-heads of *Typha* causing characteristic damage, and so the adult in my garden trap on 23 July must surely have drifted across from Barking Creek or some similiar site unless someone locally has a garden pond with *Typha.* Amongst several new and mostly quite common micros taken in the same area during the following year were a couple of nice surprises. *Ethmia funerella* came to light on 16 June, new to vice-county 18, and only the second record for the County as a whole. The attractive larvae feed on *Symphytum officinale* spinning a slight web on the underside of the leaf; it is worth searching for them during late summer and autumn in areas where the foodplant is common. Another surprise was *Bucculatrix thoracella,* bred out of nest material cleared from a nesting box used earlier by a pair of blue tits at St Mary's Churchyard Nature Reserve in East Ham. The only other South Essex locality for this species seems to be Wanstead Flats, but it is likely to be under recorded since the foodplant, common lime *Tilia* is frequent. During 1986 *B. thoracella* was also noted at Dulwich (see under V.C. 17). The third notable for East Ham during 1986 came to light on 2 July in the form of *Epinotia fraternana,* a new V.C. 18 record. This is another insect whose foodplant (*Picea* spp.) apparently does not grow locally. Two pyralids were noted for the second time only here during 1986. These were *Calamotropha paludella* on 14 July, taken before – on 17 July 1984, and *Pediasia contaminella,* taken last on 31 July 1983. The closing total of Microlepidoptera at this East Ham garden, representing trapping between April 1982 and October 1986, comprises fifty pyraloids, sixty-two tortricoids, and seventy-three other species, making a total of 185. This figure represents only the catches at light in the one small garden however, and the true figure for East Ham Microlepidoptera is most certainly considerably higher.

An L.N.H.S. field trip to the High Beach area of Epping Forest on 14 June 1986 produced mainly macros, but amongst them was a *Phyllonorycter* which eventually proved to be *P. anderidae,* a new record for Essex.

At Woodford, the Epping Forest Branch of the British Naturalists' Association manage a small area of woodland adjacent to Epping Forest as a nature reserve, the site being known as the Whitehouse Reserve. Trapping was carried out on a monthly basis during the second of the two years, although conditions were largely unfavourable, partly as a result of having to adhere to a pre-arranged schedule. Notwithstanding this minor problem a number of moths were captured, though none of them of any particular consequence. The rather attractive *Tinea semifulvella* was noted on 13 June, a species perhaps not all that common in South Essex, and the brown longhorn *Nematopogon swammerdamella* provided an interesting moment for the non-specialist audience.

At Grays, in the eastern extremity of the London area, the Rev. David Agassiz spotted an unfamiliar tineid in his church on 30 September 1986. This later proved to be an as yet unidentified member of the American genus *Homosetia.* This is a genus new to Britain, and about which practically nothing would appear to be known. A little further west at Belhus Country Park, the Rev. Agassiz found the coleophorid moth *Metriotes lutarea* in Running Water Wood during 1986, flying in some number about stitchwort flowers *Stellaria holostea* in sunshine. This is an extremely local moth, and the first record for the whole of Essex for a number of years.

Finally for South Essex, several lepidopterous larvae were noted in galls on *Salix* twigs at Walthamstow Marshes during the year. Several galls were collected and eventually three oecophorids, in the form of *Batia lunaris, B. unitella* and

Esperia sulphurella, emerged. Presumably the larvae of all species were feeding on the dead wood of the galls, since none of the three is known to act as a primary gall causer.

V.C. 19 North Essex

The Cornmill Stream S.S.S.I. at Waltham Abbey is perhaps better known for its extremely important dragonfly and damselfly fauna, as well as being noted for rare aquatic snails. Several visits during 1986 produced some useful additions to the records from this poorly studied area. Of particular interest were large numbers of the pyralid moth *Cataclysta lemnata*, of which in excess of 300 newly emerged males were noted in amongst dense vegetation at the water's edge on 17 June. The rather local and uncommon tortricoid *Apotomis lineana* was spotted on the trunk of one of the poplars *Populus* which line the eastern bank of a part of the stream on the same date; the larvae feed on crack willow *Salix fragilis*. Also on the poplar trunks here were large numbers of the momphid *Batrachedra praeangusta*.

V.C. 20 Hertfordshire

A visit to Oakhill Wood in East Barnet, at the invitation of the Barnet Group of the London Wildlife Trust, on 27 July 1985 produced eighteen species of Microlepidoptera on what was a cool and generally rather unsuitable night. These were all common species. A short distance away the leader of the trip, Clive Herbert, ran a second light in his garden at Ridgeway on the same night and took the gelechiid *Monochroa lucidella*, a wetland species whose larvae mine the stems of *Eleocharis palustris*. The yponomeutid *Orthotaelia sparganella*, whose larvae feed on *Sparganium* was also noted. No other Microlepidoptera records have been received from Hertfordshire for the two-year period.

V.C. 21 Middlesex

At Parkland Walk, N4, members of the Haringey Wildlife Group have been operating a Robinson trap on a monthly basis. The site is a section of former railway track along the top of an embankment, and this has been converted by the group to an attractive nature walk. For practical reasons however, the positioning of the trap is not ideal and the resultant catch has been poor (although in fairness the weather has not helped). Inevitably, more macros than micros have been noted, but a visit there on 13 September 1985 produced mines of *Stigmella oxyacanthae, Leucospilapteryx omissella, Phyllonorycter geniculella* and *Lyonetia clerkella*. All four are common species, but their presence in such a dismal urban area is well worth placing on record.

Further west in the vice-county Dr A. M. George reports a number of Microlepidoptera taken by him and verified by Mr B. Goater. In his garden at Northwood a number of species at light included *Rhyacionia pinicolana*, quite a local and uncommon tortricoid, seldom reported in the London area.

On 11 October 1986, whilst most entomologists were inside the Hounslow Civic Centre attending the annual fair held by the Amateur Entomologists' Society, others were outside, recording moths in the main High Street. Here, the mines of several common species were located on hedging plants in the town centre, including *Stigmella speciosa, S. crataegella, S. hybnerella, Parornix anglicella, Caloptilia syringella, Phyllonorycter geniculella, P. maestingella* and *P. corylifoliella*.

V.C. 24 Buckinghamshire

Very few records of Microlepidoptera have been received from this small part of our area, and of those that have been, most are of exceedingly common species. The only species perhaps worthy of mention is a late record of *Ypsolopha sequella* at Oakend Wood on 5 August 1983, normally a common woodland species but seldom reported in the London area.

MACROLEPIDOPTERA

Inner London

1. Inner London (Middlesex V.C. 21)

Perhaps the most noteworthy discovery for this part of Inner London during the period under review was that by Mr Ray Softly of several empty pupal cases protruding from the trunk of a *Pyrus* tree, in the grounds of the Natural History Museum at South Kensington during 1985. These subsequently proved to belong to the red-belted clearwing *Synanthedon myopaeformis*, the first record for the metropolitan area for a number of years. De Worms (1954) notes the species from Mornington Crescent, Lambeth and Brixton, and apart from the present one I have no other records for any of the thirty-three London Boroughs.

Also during 1985, Mr Softly visited the Camley Street Nature Park at Kings Cross, where several species of larger moths included the vapourer *Orgyia antiqua*, the old lady *Mormo maura* and the silver-Y *Autographa gamma*. Two other species however warrant particular mention. First, the dotted rustic *Rhyacia simulans* was recorded on 21 August. This is a species which is expanding its range, but its presence in the heart of the urban zone is of particular interest. Of even greater interest however, the annulet *Gnophos obscuratus* was taken on 13 August and again on 21 August. This is a moth of heathland, moorland and downland, which does not seem to have been noted for a number of years in the London area; indeed, apart from one at Hampstead on 20 August 1983, there may be only one other record for the present century – from Ruislip. It is possible that larvae may have been imported on plants introduced to the Camley Street site, though its presence at Hampstead Heath may indicate a small colony? Further investigation is called for.

Mr Jeremy Burge has continued to operate his trap at Fulham fairly constantly throughout the two-year period. Twelve new species were added to the list for his garden during 1985 commencing with the March moth *Alsophilia aescularia* on 3 April, followed by the light emerald *Campaea margaritata* on 27 June, the buff tip *Phalera bucephala*, lackey *Malacosoma neustria*, bordered white *Bupalus piniaria*, small blood vein *Scopula imitaria* and the least carpet *Idaea vulpinaria*, all in July, a poplar kitten *Furcula bifida*, a lesser treble bar *Aplocera efformata* and a coxcomb prominent on 24 August and finally an orange sallow *Xanthia citrago* on 1 October. A number of second sightings were also made during the year, notably the figure of eighty *Tethea ocularis*, the birch mocha *Cyclophora albipunctata*, the maiden's blush *C. punctaria*, the clay triple lines *C. linearia*, the tawny barred angle *Semiothisa liturata*, the true lover's knot *Lycophotia porphyria* and the varied coronet *Hadena compta*. There was a veritable plague of brown tails *Euproctis chrysorrhoea*, whilst the buttoned snout *Hypena rostralis* is becoming a regular visitor. A melanic riband wave *Idaea aversata* was noted on 2 July.

During 1986 nine extra species were added to the list for Mr Burge's tiny garden. The marbled white spot *Lithacodia pygarga* was captured on 26 June, followed by the barred red *Hylaea fasciaria*, the large nutmeg *Apamaea anceps* and a September thorn *Ennomos erosaria* in July, an iron prominent *Notodonta dromedarius* in August, a deep brown dart *Aporophyla lutulenta* on 24 September, and then a sallow *Xanthia icteritia*, a pale lemmon sallow *Xanthia ocellaris* and a Blair's shoulder-knot *Lithophane leautieri* in October. Additionally, five species recorded once only in the previous seven years were also noted as follows: a clouded silver *Lomographa temerata* and a common swift *Hepialus lupulinus* during June, the July highflier *Hydriomena furcata* and the oak nycteoline *Nucteola revayana* in July and a feathered thorn *Colotois pennaria* in October. Finally here, the swallowtail moth *Ourapteryx sambucaria* was captured on the extremely late date of 3 October 1986. This common species is usually on the wing during June and July, sometimes into August.

At Victoria Station on 6 July 1985, Mr A. Merritt espied a common emerald *Hemithea aestivaria,* possibly having arrived as a passenger on a train.

From the south-east corner of the London Borough of Islington, at Arlington Square, Mr M. Gandy has been operating a light-trap since 1978, and has attracted a total of 128 macros to the end of 1985. His complete list was published in the *Newsletter* of the Islington Wildlife Group during 1986. Some of his more noteworthy captures, bearing in mind the particularly urban nature of that part of London, include the oak hook-tip *Drepana binaria,* the dark marbled carpet *Chloroclysta citrata* (on 5 September 1983), the least carpet *Idaea vulpinaria,* both the varied coronet *Hadena compta* and the marbled coronet *Hadena confusa,* the blossom underwing *Orthosia miniosa* (on 15 April 1980), Svensson's copper underwing *Amphipyra berbera,* the wormwood shark *Cucullia absinthii* and the bordered straw *Heliothis peltigera* (on 15 June 1980).

An interesting late record from 1984 comes from Mr R. T. Lowe who found at Covent Garden a living pupa of the American geometrid moth *Ennomos subsignaria* (Hbn.) on 26 April hanging from *Asparagus plumosa* imported from Florida, U.S.A. The moth emerged on 2 May and was donated to the Natural History Museum by Mr Lowe.

2. Inner London (V.C. 17 Surrey)

The small number of Inner London records received from south of the River Thames includes the six-spot burnet *Zygaena filipendulae* at the William Curtis Ecological Park site by Tower Bridge on 25 July 1985, brown tail larvae *Euproctis chrysorrhoea* at Duke Street by London Bridge in 1986, both reported by M. J. Hammerson, and a male black arches *Lymantria monacha* which was taken at an office window light at the Elephant and Castle during 1985 by Mr R. McCormick. This latter record is apparently the first for this species in the Inner London area – normally it prefers to be in oak woodland.

V.C. 16, West Kent

This vice-county produced the only silver-striped hawk moth *Hyles lineata* apparently to reach London during a rather large and unusually early influx of this species into Britain during 1985; Mr J. Parry picked up a singleton in Beckenham High Street on 18 April. Other notable migrants during the two-year period included a humming-bird hawk-moth at Orpington on 21 September 1986, in the garden of Dr R. J. Chandler and a single white speck *Mythimna unipuncta* taken by Mr E. Hare at Erith on 25 July, together with swarms of aphids, and reported to me by Mr R. F. Bretherton.

At his garden in Orpington during 1985 Mr P. A. Sokoloff had a maiden's blush *Cyclophora punctaria* on 1 September, new for the Orpington area. This delicate geometrid feeds as a larva on oak *Quercus* and, reputedly, birch *Betula,* and is quite scarce in the London area generally. On 30 September he took an example of the immigrant vestal moth *Rhodometra sacraria,* whilst earlier in the year on 24 April a single male tawny pinion *Lithophane semibrunnea* came to light – only the second here in ten years. Its congener Blair's shoulder knot *L. leautieri* was first noted in the Orpington area during 1980 and was recorded with great excitement. Its rapid eastwards spread continues and Mr Sokoloff captured nearly two hundred individuals in his garden during 1985. The following year Mr Sokoloff had a humming-bird hawk in his garden on 13 July, and a bordered straw on 6 September. A totally unexpected visitor was the beautiful snout *Hypena crassalis* on 16 July. The larval foodplant of bilberry *Vaccinium myrtillus* does not grow locally, and so there is a possibility that this too was an immigrant example. In earlier years the species was noted in similar situations, miles away from the nearest bilberry and thus possibly indicating immigration, at Dartford on 8 July 1981 (B. K. West) and Wimbledon on 25 July 1985 (J. V. Dacie).

A slightly odd record was obtained by Mr Sokoloff on 14 July, when a male of the day-flying vapourer moth *Orgyia antiqua* entered the light-trap: this is the second such nocturnal capture of this species here. The grey shoulder knot *Lithophane ornitopus* is reported to be on the increase locally with a stronghold in Petts Wood, and it is from this locality that the first Kent record of the balsam carpet *Xanthorhoe biriviata* was made during 1986 by D. O'Keefe. The specimen was a fertile female, which may suggest a local colony; the foodplant *Impatiens parviflora* grows nearby in the wood.

From his trap at Dartford Mr B. K. West recorded 285 species of larger moths during 1985 of which a number are worthy of mention.

The maiden's blush *C. punctaria* has been discussed under the Orpington report above; A further example was taken at Dartford on 2 July. The barred rivulet *Perizoma bifaciata* is unusual in that it can remain in the pupal stage for up to five years, and although quite widespread in the south it is seldom reported in our area – perhaps through under-recording. Mr West took two on 18 August, whilst later on 25 August he noted the September thorn *Ennomos erosaria*. The last geometer, the sloe pug *Chloroclystis chloerata* was noted in the trap on 13 June, which is of interest because this species is not often attracted to light. The poplar kitten *Furcula bifida* was noted on 1 and 7 July, the white satin *Leucoma salicis* on 13 July, the ruby tiger *Phragmatobia fuliginosa* on 13 August and the rather attractive rosy footman *Miltochrista miniata* on 1 and 31 August. Examples of the rather uncommon barred hook-tip *Drepana cultraria* were noted on 27 May and 29 August. Amongst the noctuids the grey shoulder knot *Lithophane ornitopus* and Blair's shoulder knot *L. leautieri* were noted, along with tawny pinions *L. semibrunnea* on 20 and 21 May. Sixteen black rustics *Aporophyla nigra* were noted between 22 September and 9 October, whilst both grey and dark daggers *Acronicta psi* and *A. tridens* were caught during the year. The latter is seldom reported and can only be separated from the former by an examination of the claspers of the male genitalia. This relatively easy task can be performed with a good hand lens without recourse to dissection. The oak nycteoline *Nycteola revayana* was noted on 10 October. This is a species which could easily be mistaken for a large tortricoid such as an *Acleris* by an inexperienced observer; accordingly it is probably much overlooked in the London area, and its distribution map will doubtless become more impressive as interest in the 'micros' increases! Far less common is the triple spotted clay *Xestia ditrapezium*, noted at Dartford on 24 July, and less common still is the reddish light arches *Apamea sublustris*, noted on 15 July. The larvae of this species are unknown in the wild in Britain, but probably feed on the roots of various grasses. The rosy marbled *Elaphria venustula* was noted on 10 July and is a regular visitor to the trap here, as is the waved black *Parascotia fuliginaria*, a secretive species which is locally common in the London area.

Despite the poor summer of 1986, Mr West's garden trap attracted a number of quite good insects during that year. Undoubtedly the best capture was a female *Eupithecia abietaria* on 21 July, the first for West Kent for over a century. A female water ermine *Spilosoma urticae*, presumably a wanderer from the Thames Marshes, arrived on 27 June, whilst on 28 June there was a single coronet *Craniophora ligustri*, only twice previously recorded here and, like the others, of the melanic form *coronula*. The waved black *Parascotia fuliginaria* is maintaining its presence here too, with four captured during the year – on 20 and 27 July, and 1 and 7 August. Another newcomer, in this the eighteenth year of running the trap in this garden, was the buff footman *Eilema deplana*, which has extended its range in the south-east during recent years. Other moths of interest during the year were the clouded-bordered brindle *Apamea crenata* on 22 June, the triple spotted clay *Xestia ditrapezium* on several dates, the merveille du jour *Dichonia aprilina* on 5 October, the bordered straw *Heliothis peltigera* on 12 July, the brindled white spot *Ectropis extersaria* on two dates in June, the September thorn *Ennomos erosaria* on 11 August, the maiden's blush *Cyclophora punctaria* on 10 August and 23 September, and the cream-spot tiger *Arctia villica* on 23 June. The bleached pug *Eupithecia expallidata* is common here, and one came to the trap on 22 June. A third brood specimen of the engrailed *Ectropis bistortata* was noted on 13 October, the brown scallop *Philereme vetulata* on 11 and 25 July, the phoenix *Eulithis prunata* on 13 and 14 July, and the lilac beauty *Apeira syringaria* on two dates each in June and July. Finally, Mr West comments that the percentages of the three forms of the peppered moth *Biston betularia* for his area during 1986 were as follows: type – 21.5%, ab. *insularia* – 19%, and ab. *carbonaria* – 59.5%, and observes that the steady decline of the *carbonaria* form continues in Dartford.

At West Wickham, Mr J. M. Chalmers-Hunt took a female maiden's blush *Cyclophora punctaria* at light on 2 July 1985, and at the same locality during 1986 he captured a melanic specimen of the scalloped hazel *Odontopera bidentata* at light on 10 June 1986, the first example of this form which he had seen there. Also at West Wickham during the latter year he had the mocha *C. annulata* on 26 June, the blackneck *Lygephila pastinum* on 15 July, the beautiful snout *Hypena crassalis* on 3 August, new to the locality, the dusky sallow *Eremobia ochroleuca* on 13 August and the phoenix *Eulithis prunata* on 18 August. He also notes a female muslin *Diaphora mendica* at Dartford on 29 May 1986, and several examples of the chalkland subspecies *palustrella* Ver. of the five-spot burnet *Zygaena trifolii* at Otford on 3 June 1985.

Slightly further in towards London proper, Mr J. Maskray ran a Robinson trap on the roof of the Greenwich Borough Museum in Plumstead High Street on thirty-two nights during 1986, from 23 January to 4 December. The light was turned on at 5 p.m. each evening and off again at 9 a.m. the next morning, and in this way sixty-six species of Macrolepidoptera were recorded. Whilst most were common species, it is very interesting to note just which species are able to survive in such a hostile environment as Plumstead High Street, and indeed what species can be taken in a trap at that height, hidden from the ground by the roofs of other buildings. Some of the more interesting records include the miller *Acronicta leporina* on 26 June, the blotched emerald *Comibaena bajularia* on 3 July (more normally associated with woodland, and perhaps therefore a stray from elsewhere), the varied coronet *Hadena compta* on 10, 11 and 21 July, the golden plusia *Polychrysia moneta* on 10 July, a broad-barred white *Hecatera bicolorata* on 17 July, a true lover's knot *Lycophotia porphyria* on 21 July, the plain pug *Eupithecia simpliciata* on 24 July and finally a bird's wing *Dypterygia scabriuscula* on 25 July. The last moth of the year was an angle shades *Phlogophora meticulosa* on 23 October.

Earlier Kent records received too late for inclusion in the last review include the least carpet *Idaea vulpinaria* in an m.v. trap at Orpington on the very late date of 31 October 1984 (R. G. Chatelain); a hornet clearwing *Sesia apiformis* at Footscray Meadows, Sidcup on 27 July 1984 (D. J. Wilson); and a goat moth *Cossus cossus*-infected oak tree near to Greenwich Park at Blackheath in May 1984 (A. A. Allen).

V.C. 17, Surrey

Mr R. A. Softly spent a week at the Juniper Hall Field Studies Centre from 19 to 26 July 1985, during which time an impressive 97 macros were taken at light there. Amongst these were five sphingids, including the pine hawk *Hyloicus pinastri*, a seldom reported species in our area. The lobster *Stauropus fagi* was amongst the five 'prominents' noted, whilst thirty-two geometers included both the typical form and the melanic ab. *carbonaria* Jordan of the peppered moth *Biston betularia*, the least carpet *Idaea vulpinaria* and the barred red *Hylaea fasciaria*. Of greater interest however was the capture of the Kent black arches *Meganola abula*, a univoltine species on the wing in June and July and rarely seen away from the coast except at isolated localities in Hampshire, Berkshire and Surrey. This record is only the third for the species in the London area. Another particularly good capture was the dew moth *Setina irrorella*, which also occurs locally at

Mickleham and Box Hill. The larvae feed in an exposed position in bright sunshine on various yellow and black lichens on rocks where they are extremely difficult to find. Forty-six noctuids also included some notable species, including the star-wort *Cucullia asteris*, which feeds on *Solidago* at inland sites as opposed to the more usual *Aster tripolium* in the Thames estuary area, the reddish light arches *Apamea sublustris*, rather a rarity in the London area, and the waved black *Parascotia fuliginaria*, whose larvae are unusual in that they feed on the various fungi growing beneath fallen timber. The adults are rarely seen except at light.

Elsewhere Mr Softly reports mature larvae of the grass emerald *Pseudoterpna pruinata* on *Ulex* at Headley Heath on 16 June, from which same locality Mrs P. Dawe reports the orange underwing *Archieris parthenias* on 3 April 1985.

Mr D. R. Drakeford's continuing survey of the Lepidoptera on Wimbledon Common produced a number of common species during the two-year period, including the puss moth *Cerura vinula*, the pale eggar *Trichiura crataegi* and the oak eggar *Lasiocampa quercus*. From the same area the members of the Rotary Club of Putney Nature Conservation Scheme report an orange/light orange underwing *Archiearis parthenias/notha*, but in the absence of a specimen it is not possible to state which species was involved.

At North Cheam Mr R. F. McCormick's garden list rose to 214 macros at the end of 1985, thanks to the addition of several species during the year including the large emerald *Geometra papilionaria*, the mallow *Larentia clavaria*, the plain pug *Eupithecia simpliciata*, the August thorn *Ennomos quercinaria*, the pale oak beauty *Serraca punctinalis*, barred red *Hylaea fasciaria*, small elephant hawk *Deilephila porcellus*, the poplar kitten *Furcula bifida* and the six-striped rustic *Xestia sexstrigata*, as well as the sharp angled carpet *Euphyia unangulata* on 5 August. During the following year further species were added, most noteworthy amongst these being the spruce carpet *Thera britannica*, the small waved umber *Horisme vitalbata*, the light brocade *Lacanobia w-latinum*, the blackneck *Lygephila pastinum* and the buttoned snout *Hypena rostralis*. At the end of 1986 the total of Macrolepidoptera recorded by Mr McCormick in his garden stood at 214.

In the same general area of Sutton Mr A. Merritt noted an orange sallow *Xanthia citrago* on 26 July 1985, whilst on the North Downs to the west of Buckland Hills he noted the burnet companion *Euclidia glyphica* three weeks earlier. Also at Buckland Mr C. Hart captured one of the three vestals *Rhodometra sacraria* reported for our area during 1985, this one on 23 September.

From the urban north-east of the vice-county Miss Rosa Davis has sent me another most useful list from the Dulwich area. Amongst those taken in her garden here were the grey pine carpet *Thera obeliscata*, the treble brown spot *Idaea trigeminata*, the scarce silver lines *Bena prasinana*, the true lover's knot *Lycophotia porphyria*, the poplar grey *Acronicta megacephala* and the sycamore *A. aceris*.

At nearby Dulwich Upper Wood Nature Reserve, I ran two light traps on 19 July 1985 at the invitation of the then warden Andrew Loan. Amongst several mostly very common species was the larch pug *Eupithecia lariciata*, a moth apparently known from only a handful of localities in our area.

The night of 28/29 September 1985 saw the Society's Ecology and Entomology Section field trip to Bookham Common. The few who braved that particularly chilly evening were rewarded by numbers of the attractive brindled green *Dryobotes eremita*, although the oak lutestring *Cymatophorima diluta* which had been super-abundant in the same spot during the same month in 1984 was represented on this occasion by but a single example. Also of interest was a marbled white spot *Lithacodia pygarga* on perhaps a rather later than normal date. Although this species may have a partial second brood on the Continent it is thought to be univoltine in Britain, flying from July to September. The black rustic *Aporophyla nigra* was also noted in small number here.

Sir John Dacie's garden trap at Wimbledon produced three new species for 1985. These were the beautiful snout *Hypena crassalis* on 27 July, the green carpet *Colostygia pectinataria* on 29 August and the immigrant white-speck *Mythimna unipuncta* on 1 October. Sir John also contributes a comment on the increasing abundance of Blair's shoulder-knot *Lithophane leautieri* in the Wimbledon area, with nine on 1 October, twelve on 2 October, ten on 3 October and numbers from one to five on ensuing evenings.

Eight new species were added to the South Croydon garden list of Mr B. Skinner during 1985, in the form of the oak lutestring *Cymatophorima diluta*, the blotched emerald *Comibaena bajularia*, the dark marbled carpet *Chloroclysta citrata*, the lesser treble bar *Aplocera efformata*, the lunar marbled brown *Drymonia ruficornis*, the orange sallow *Xanthia citrago*, the pale lemon sallow *X. ocellaris* and the small dotted buff *Photedes minima*. Of particular interest also was the rare ab. *sutaki* Dioszeghy of the heart and dart *Agrotis exclamationis* taken at light. In this striking aberration both the claviform and the orbicula stigmata are absent. In spite of the weather the following year saw seven new species added to his list, which were the flame carpet *Xanthorhoe designata*, the small white wave *Asthena albulata*, the scorched wing *Plagodis dolabraria*, the scarce prominent *Odontosia carmelita*, the common footman *Eilema lurideola*, the lead-coloured drab *Orthosia populeti*, and the dusky-lemon sallow *Xanthia gilvago*. The pale lemon sallow did not make a repeat appearance during this second year, but Mr Skinner did manage to breed a couple of moths from larvae found in fallen poplar *Populus* catkins at New Addington. The catkins also apparently yielded a few *Agrochola circellaris* in addition.

Mr C. B. Ashby (per R. F. Bretherton) took two pale mottled willows *Caradrina clavipalpis* on the same night as two examples of the immigrant pyrale *Nomophila noctuella* on the very early date of 16 April 1985. This is a moth more normally associated with the summer, although it can appear as early as March, but it is unlikely that these are immigrant examples.

To end the report for Surrey, Mr G. A. Collins has sent me a list of 264 species from his garden trap at South Croydon. Seven species noted for the first time during 1985 were the flame carpet *Xanthorhoe designata* on 30 August, the barred rivulet *Perizoma bifaciata* on 28 August, the scorched wing *Plagodis dolabraria* on 24 July, the August thorn *Ennomos quercinaria* on 25 July, four grey shoulder knots *Lithophane ornitopus* between 22 March and 9 April, three large nutmegs *Apamea anceps* between 4 and 8 July (apparently rather uncommon in Surrey), and a single example of the immigrant small mottled willow *Spodoptera exiqua* on 25 July. The first record here for a second-brood light emerald *Campaea margaritata* was made on 10 October, and a late golden plusia *Polychrysia moneta* on 8 September. A single flounced chestnut *Agrochola helvola* on 8 September was only the second here, whilst less common species included the spruce carpet *Thera britannica*, the grass rivulet *Perizoma albulata*, the treble bar *Aplocera plagiata* (which is apparently out-numbered by *A. efformata* here), the dark dagger *Acronicta tridens* and the buttoned snout *Hypena rostralis*. Examination of genitalia revealed the marbled minor *Oligia strigilis* (five between 26 June and 4 July), the rufous minor *O. versicolor* (thirteen between 1 and 15 July), and the tawny minor *O. latruncula* (eighty-three from 4 June to 18 July), as well as both the common rustic *Mesapamea secalis* and the lesser common rustic *M. secalella*, although not all were checked. A big increase in the number of Blair's shoulder-knot *Lithophane leautieri* was noticed, with thirty-six during 1983, eighty-two during 1984 and a staggering 207 from 23 September to 22 October 1985; during the following year a further six species were added to the list in the form of a marbled white spot *Lithacodia pygarga* on 27 June, the brindled white spot *Ectropis extersaria* on 6 July, two larch pugs *E. lariciata* – one each on 16 and

21 July, an orange swift *Hepialus sylvina* on 13 August, a narrow-winged pug *E. nanata* on 21 August and a stout dart *Spaelotis ravida* on 1 September.

Finally, away from his moth trap but still in the garden, Mr Collins found the current clearwing *Synanthedon tipuliformis* on 4 July 1985, and later on 15 July the red-belted clearwing *S. myopaeformis*.

V.C. 18, South Essex

Mr G. Gray of the Passmore Edwards Museum reports having observed an example of the immigrant humming-bird hawk moth *Macroglossum stellatarum* in his garden at Woodford, adjacent to the golf course during the week from 4 to 11 July 1986, whilst another immigrant, the small mottled willow *Spodoptera exiqua*, was noted at Rainham on 15 July 1985 by Mr M. Halsey (per R. F. Bretherton).

From the Honey Lane Plain area of Epping Forest, Mr J. H. Bratton reported a male yellow-legged clearwing *Synanthedon vespiformis* feeding on a thistle flower on 8 August 1985, whilst on 2 June 1986 Mr R. V. Goulding found larvae of the oak eggar *Lasiocampa quercus* feeding on bramble *Rubus fruticosus* agg. near to Connaught Water. A trapping session at High Beach on 14 June 1986 produced a large number of the barred hook-tip *Drepana cultraria*, as well as the typical form of the least black arches *Nola confusalis*. The Epping Forest form ab. *columbina* Image was not seen on this occasion. The typical form of the peppered moth *Biston betularia* was present in more or less equivalent number to the melanic ab. *carbonaria* Jordan, though the intermediate ab. *insularia* was less numerous. Other species here included the alder moth *Acronicta alni*, the grey birch *Aethalura punctulata* and both typical form and ab. *combusta* Haworth of the clouded-bordered brindle *Apamea crenata*.

Elsewhere in Epping Forest during 1986, Mr T. Green made a number of interesting captures. Particularly noteworthy was the discovery of a colony of the common heath *Ematuga atomaria*, a very rare moth in Essex. The last Epping Forest record was on 16 May 1983, and the last Essex sighting, prior to the present one, was at Harlow (also within the L.N.H.S. area), in June 1982, when one was found in a building. Essex lepidopterists had presumed this insect to be extinct in the County. Mr Green also captured eight great oak beauties *Boarmia roboraria*, another Essex rarity. The last record for the entire county was in 1984, which was itself the first Essex record since 1958. The capture of eight in 1986 clearly indicates the species is breeding here. Another record made was the third Epping Forest rosy marbled moth *Elaphria venustula*, a four-dotted footman *Cybosia mesomella* and a colony of the striped wainscot *Mythimna pudorina*, a very local and scarce moth in Essex, more usually found on the coast, and presumed to be feeding on *Molinia*. The presence of this colony would explain the capture of four individuals by Mr Green in his garden at Theydon Bois during 1984!

In my own (now former) garden at East Ham, the total number of macros recorded from my arrival in April 1982 to my departure in October 1986 stands at 225, of which no less than twenty-three were added during the two years under review. In the first year, ten new species were the cinnabar *Tyria jacobaeae* which is a day flier not usually taken at light; four noctuids – the miller *Acronicta leporina*, the golden plusia *Polychrysia moneta* (only the second record for the East Ham area as a whole), the gothic *Naenia typica* and the beautiful brocade *Lacanobia w-latinum;* and five geometrids in the form of the magpie *Abraxas grossulariata*, the common white wave *Cabera pusaria*, the feathered thorn *Colotois pennaria*, the shaded pug *Eupithecia subumbrata* and the white spotted pug *E. tripunctaria*. The following year saw two examples of the iron prominent *Notodonta dromedarius*, more normally a woodland insect than one of urban areas, on 16 June and 14 July, the common swift *Hepialus lupulinus* on 16 June (possibly imported as larvae in turves recently laid in the garden), the common snout *Hypena proboscidalis* on 10 September and 8 October and a total of four pale-shouldered brocades *Lacanobia thalassina*, one on each of four dates in

June. The immigrant bordered straw *Heliothis peltigera* was taken on 2 July, whilst the bird's wing *Dypterygia scabriuscula* was captured on 4 July. The black rustic *Aporophyla nigra* has been earlier reported as spreading in our area; The first, and so far the only one, for East Ham came on 29 September, whilst a double lobed on 12 July completes the noctuid additions. Four geometers complete the 1986 additions: these are the small white wave *Asthena albulata*, the bordered white *Bupalus piniaria*, the mottled pug *Eupithecia exiquata* and the early thorn *Selenia dentaria*. A further nine species were noted for the second time only here. These were all single examples of the broom moth *Ceramica pisi* and the cream-bordered green pea *Earias clorana*, both on 2 July, the fan-foot *Herminia tarsipennalis* on 14 July and the small dotted buff *Photedes minima* on 26 July, the six-striped rustic *Xestia sexstrigata* and the twin-spotted wainscot *Archanara geminipuncta* both in August, the sallow *Xanthia icteritia* on 29 September, and finally in October the shaded broad bar *Scotopteryx chenopodiata* and two examples of Blair's shoulder-knot *Lithophane leautieri*.

Other notables here included an extremely worn clouded drab *Orthosia incerta* on 2 June 1986, an extremely late date indeed, a single wormwood shark *Cucullia absinthii* in July 1985 (I have taken just one every year here to 1985, but in 1986 it was not recorded at all), a frosted orange *Gortyna flavago* on 11 October 1986, last captured here in 1984, and a halved gynandromorph of the shuttle-shaped dart *Agrotis puta* on 29 August 1985. Two species conspicuous by their absence during the two-year period were the bordered sallow *Pyrrhia umbra* and the campion *Hadena rivularis*, both of which were recorded in low numbers up to 1984.

Elsewhere in the vice-county lights were run at Wanstead Park, where the olive *Ipimorpha subtusa* and the gothic *Naenia typica* were added to the already extensive species list, and at Weald Park near Brentwood, a superb area containing much ancient oak woodland, where I was fortunate to be able to leave a trap running in the garden of Foxdown Cottage, in the very centre of the park, by kind permission of the owner Mr P. Hodges. A number of typical woodland insects were noted, including the bird's-wing *Dypterygia scabriuscula*, the chocolate tip *Clostera curtula*, the marbled brown *Drymonia dodonaea* and the lunar marbled brown *D. ruficornis*.

V.C. 19, North Essex

No records have been received from this vice-county area for 1985 or 1986.

V.C. 20, Hertfordshire

Mr B. Goater reports an extremely poor two years at Bushey, where the only moth of note in his garden was a single humming-bird hawk *Macroglossum stellatarum* in the evening of 26 July 1985. A first for this district, the moth was feeding at jasmine flowers.

Two lights were operated in the East Barnet area on the night of 27/28 July 1985 by members of the Barnet Wildlife Group. One in the garden of Mr C. Herbert produced twenty-seven common species of macro between 20.30 and 02.00 hours, including the rather local double lobed *Apamea ophiogramma*. The second lamp, in Oakhill Wood produced a disappointingly small catch of only twenty species of common moths to a sheet, a result of the weather rather than the habitat. Elsewhere in the London part of Hertfordshire Mr Herbert recorded four or five chimney sweepers *Odezia atrata* disturbed from long grass at King George's Fields, Barnet on 30 June 1985, whilst at Broxbourne Woods he saw several speckled yellows *Pseudopanthera macularia* flying in the early evening sunshine. Chimney sweepers were also noted at Northaw House on 9 July 1985 by Mr N. Bowman.

At Broxbourne Mr B. Skinner reports a four-spotted footman *Lithosia quadra* at m.v. light on 31 July 1985.

V.C. 21, Middlesex

Mrs A. Hughes ran a trap for the first time in her garden at Enfield during 1985, and managed to record a number of expected common species. Of particular interest however was an early grey *Xylocampa areola* which she photographed in the trap on 26 June!

Mr R. T. Lowe has sent me another impressive list of captures made in his garden at Hampstead Garden Suburb. 1985 started with the chestnut *Conistra vaccinii* and the March moth *Alsophila aescularia* on 27 February, when many other lepidopterists were still hibernating if their lists are anything to go by, and at the other end of the year when most of us had switched off our lights for the winter Mr Lowe was capturing insects such as the satellite *Eupsilia transversa,* the winter moth *Operophtera brumata,* feathered thorn *Colotois pennaria* and dark sword grass *Agrotis ipsillon* on 1 December, a dark chestnut *Conistra ligula,* a large yellow underwing *Noctua pronuba* and the brick *Agrochola circellaris* the next night, a marbled carpet *Chloroclysta truncata* on 3rd and to finish the year a mottled umber *Erannis defoliaria* on 4 December. The record of *N. pronuba* is the latest recorded for the London area to date. In between these extreme dates, three newcomers during 1985 in the form of the small waved umber *Horisme vitalbata* on 11 July, the vestal *Rhodometra sacraria* on 20 September and Blair's shoulder-knot *Lithophane leautieri* on 5 October brought his garden total for macros to 178 species. Repeat appearances were made here by the tawny pinion *Lithophane semibrunnea,* the black rustic *Aporophyla nigra* and the great oak beauty *Boarmia roboraria,* whilst a single ruby tiger *Phragmatobia fuliginosa* was noted on 29 August after an absence of some years.

A late record of note from Mr Lowe's trap is worth mentioning here. The rare ab. *obsoleta* Tutt of the heart and dart *Agrostis exclamationis* was attracted to light on 21 July 1984.

In the same general region of London, Mr P. R. Hall recorded some interesting species during 1985. The broad barred white *Hecatera bicolorata* was noted on 4 July, and again on 16 July, not having been taken here previously. Another newcomer was the orange sallow *Xanthia citrago* which seems to have had a good year in the London area generally during 1985. An uncommon melanic form of the double lobed *Apamea ophiogramma* presented itself on 23 July, whilst the figure of eighty *Tethea ocularis* was plentiful during the first week of that month. The grey arches *Polia nebulosa* and Vine's rustic *Hoplodrina ambigua* both had a good year, whilst a nice newcomer on 16 May was the maiden's blush *Cyclophora punctaria,* which seems to have been particularly evident in the south of our area during that year. Svensson's copper underwing *Amphipyra berbera* was far less numerous than the common copper underwing *A. pyramidea,* the latter species appearing in numbers slightly later than the former. Two species in particular stand out on Mr Hall's 1986 list. These are the peacock moth *Semiothisa notata,* taken on 29 June, quite uncommon in this part of Middlesex, and this example showing a tendency towards melanism, and also the spruce carpet *Thera britannica* on 11 June, another decidedly local species in our area. It seems worth noting at this juncture that a pug taken here on 31 May 1984 has proved on dissection to be the ochraceous pug *Eupithecia indigata,* a Scots pine *Pinus sylvestris* feeder which is particularly scarce in the London area as a whole.

Nearby, at Highgate Wood, Mr M. J. Hammerson noted forty-three different macros during the two years under review, including the bird's wing *Dypterygia scabriuscula* and the wormwood pug *Eupithecia absinthiata.*

Mr P. Edwards ran a trap at Hanwell on the night of 24/25 August 1985 and recorded twenty-two species of Macrolepidoptera including a dusky copper underwing *A. berbera* and a single lunar yellow underwing *Noctua orbona,* quite a scarcity generally in Middlesex.

From the Brent Cross Shopping Centre complex on 12 September 1985 Mr M.

J. Hammerson reports a brimstone moth *Opisthograptis luteolata*, a rather unusual situation for this very common moth, whilst in his garden in Haringey he took a Blair's shoulder-knot *Lithophane leautieri* on 20 October in the same year. At Highgate Woods a number of fairly prevalent insects recorded during that year included the melanic ab. *angelicata* Barrett of the white-spotted pug *Eupithecia tripunctaria* on 31 July.

Mr L. R. Williams noted the six-spot burnet *Zygaena filipendulae* at Welsh Harp Reservoir during 1985, whilst from Wood Green comes a late record by Mr D. Perry (per D. Bevan) of six larvae of the emperor moth *Saturnia pavonia* feeding on *Cotoneaster horizontalis* during 1984. This beautiful insect was also noted during 1985 at Alexandra Park by Mr J. King. A rather lost old lady was noted on the north-bound platform of Manor House Underground Station by Mr A. and Mrs O. Hall on 15 August 1985 – presumably *Mormo maura* was intended and not *Homo sapiens*! A recent note on the aestivation of this species by Sir John Dacie (*Entomologist's Rec. J. Var.* **97:** 59-62) may indicate that perhaps the presence of this large moth in an underground station was not altogether accidental.

A humming-bird hawk-moth *Macroglossum stellatarum* was seen in the garden of Mr P. E. Beard, at Honeycroft Hill, Uxbridge, on the evening of 26 June 1986, the first here for fifteen years.

On 18 September 1985 a small green larva which was clearly of a hawk-moth was found on a tree at Strand on the Green, Chiswick, and given to Mr B. Verdcourt. Although this was only three centimetres in length it pupated shortly after capture to produce a small female lime hawk *Mimas tiliae* with deformed wings and mouthparts (*Entomologist's Rec. J. Var.* **99:** 10).

Mr W. E. Minnion has sent me his complete list of captures from his garden at Pinner, for the period 1979 to 1986, and a number of newcomers during 1986 period here bring his total to 238 macros at the end of that year. Particularly interesting were the dog's tooth *Lacanobia suasa*, of which a single example was taken during the year, whilst the lead-coloured pug *Eupithecia plumbeolata*, the great oak beauty *Boarmia roboraria*, the brindled white-spot *Ectropis extersaria* and the birch mocha *Cyclophora albipunctata*, all seem out of place in the garden, though all occur in Park Wood, Ruislip, about two miles to the west and it seems possible that some peculiarity in the weather may have moved them in this direction. The increase in woodland species in the garden is noticeable however, presumably because people moving in when the farmland was developed for housing in the nineteen thirties planted trees which are now maturing.

Ten species noted at Hammersmith Hospital, adjacent to Wormwood Scrubs, during 1986 by Dr A. M. George included the early thorn *Selenia dentaria* on 22 May and the dark chestnut *Conistra ligula* on 14 October. Dr George has also sent me some useful records from the Ruislip area. A number of new records were made for his garden at Northwood during 1985, including the small elephant hawk *Deilephila porcellus* on 18 June, and on the same night the treble lines *Charanyca trigrammica* and two examples of the shears *Hada nana*. The last two species were recorded again on 30 June. The woodland-dwelling blotched emerald *Comibaena bajularia* was present on 5 July and a single male black arches *Lymantria monacha* on 21 August. The small nutmeg *Dicestra trifolii* is apparently scarce in this part of Middlesex; Dr George reports singletons on 21 and 28 August. This latter date also produced a male chocolate tip *Clostera curtula* and a September thorn *Ennomos erosaria*. The night of 12/13 September produced sixty-six lesser yellow underwings, amongst which was a single example of the ab. *sagittifer* Cockayne, more usually associated with the Isles of Scilly and rare elsewhere in Britain. A second example was also taken in Middlesex during 1985, at Hampstead where Mr R. A. Softly took an example on 22 September, which he exhibited at the 1985 annual exhibition of the British Entomological and Natural History Society. A male December moth *Poecilocampa populi* was trapped on 7 November along with a single grey shoulder-knot *Lithophane ornitopus,* also noted on 4 and 16 November here. During 1986, a further fourteen species were added to the list, beginning with an oak beauty *Biston strataria* on 19 April, and followed in June by the white-spotted pug *Eupithecia tripunctaria,* the pale tussock *Dasychira pudibunda* and Freyer's pug *E. intricata arceuthata* on 17 June, with an ingrailed clay *Diarsia mendica* and a May highflier *Hydriomena impluviata* on 29 of that month. July brought a leopard moth *Zeuzera pyrina* and a beautiful carpet *Mesoleuca albicillata,* whilst 29 August brought the first lesser treble bar *Aplocera efformata* here. A frosted orange *Gortyna flavago,* new to the garden on 23 September was only the second record for the Ruislip area of Middlesex in the last ten years, whilst a Blair's shoulder-knot *Lithophane leautieri* on 2 October was only the second ever local record, perhaps indicating that this recent coloniser is less common in the west of our area than in Kent and Surrey where it is abundant, and South Essex where it is only recently becoming common. Another individual was trapped by Dr George in his garden five days later. Finally, the black rustic *Aporophyla nigra* completed the garden additions on 7 October. Several moths noted here for only the second time included the pale-shouldered brocade *Lacanobia thalassina* and the blotched emerald *Comibaena bajularia* on 5 July and the marbled white spot *Lithacodia pyqarqa* five days later. Other garden highlights included a grey shoulder-knot *L. ornitopus* on 27 October and a male December moth *Poecilocampa populi* on 24 November.

Away from his garden Dr George had four examples of the marsh pug *Eupithecia pygmaeata* at Croxley Moor on 15 June 1985, only recorded once before in the London area – by W. E. Minnion in 1955 – whilst a little further south at Bishops Wood he noted the chevron *Eulithis testata* on 24 August. In 1986, he again took the marsh pug at Fray's Water Meadows on 29 June. From the Maple Cross Nature Reserve a number of new species were recorded, bringing the macro list for this interesting site to 158 at the end of 1985. The beautiful golden-Y *Autographa pulchrina,* the scorched carpet *Ligdia adustata,* the rivulet *Perizoma affinitatum* and the yellow tail *Euproctis similis* were amongst the newcomers, along with the poplar kitten *Furcula bifida* and five dingy footmen *Eilema griseola* on 3 August. In the following year he recorded a single barred red *Hylaea fasciaria* on 18 July, also a new record for the reserve.

Elsewhere in the Ruislip Natural History Society's recording area Dr George reports a blue bordered carpet *Plemyria rubiginata* on 19 July in the Northwood area, while at Gutteridge Wood larvae of the emperor *Saturnia pavonia* were seen on hawthorn *Crataegus* sp. during July; previous local records of this species are of two males assembled in 1978 some distance away, and in 1955 there was one at West Ruislip Station, and this perhaps points to a local release of larvae or adults? At Grosvenor Crescent, Hillingdon, a least carpet *Idaea vulpinaria* on 10 August was the first here since 1976, whilst a buttoned snout at Ickenham (Uxbridge) Golf Course on 6 June was the first recent local record. A great oak beauty *Boarmia roboraria* was noted again at Northwood Cars in June, whilst at Bishops Wood on 1 May fifteen red chestnuts *Cerastis rubricosa* were captured. The balsam carpet *Xanthorhoe biriviata* was again seen at its usual place in 1986, and to complete this round-up of Middlesex notables, a dog's tooth *Lacanobia suasa* taken by Mr W. E. Minnion at Pinner on 10 August 1986 was a new record for the Ruislip Society's area.

V.C. 24, Buckinghamshire

No records of note have been received for 1985 or 1986.

References

B.E.N.H.S. 1981. *An Identification Guide on the British Pugs: Lepidoptera: Geometridae.* British Entomological and Natural History Society, London.

DE WORMS, C. G. M. 1954. The moths of London and its surroundings *Lond. Nat.* **33:** 101-146.

PLANT, C. W. 1985. A review of the Lepidoptera of the London Area for 1983 and 1984. *Lond. Nat.* **64:** 45-62.

SKINNER, B. 1984. *A Colour Identification Guide to British Moths.* Viking, London.

THE SURVEY OF LONDON'S LEPIDOPTERA

Phase Two

DISTRIBUTION MAPS OF LONDON'S MOTHS

Following the successful project to map the distributions of London's butterflies, it is now proposed to treat the moths in a similar manner. Although it is unlikely to be practical to map moths on the same detailed scale as butterflies, it is nevertheless intended to retain the tetrad as the basic recording unit, perhaps converting up to a more convenient-sized square when maps are eventually published. An existing backlog of several thousand post-1979 records is currently being put on to the Society's computer database, paving the way for detailed analyses at a later stage. Lepidopterists of all persuasions are invited to contribute complete lists of their captures within three broad date bands: pre-1960, 1960-1979, and 1980 to present. The project will include all Microlepidoptera as well as the macros, and I would like to be well on the way to producing reasonable maps by the end of 1992 – hopefully earlier. Those who have not contributed records for some time are invited to note the author's new home address which is repeated at the foot of this notice, and to which records should be sent to avoid overburdening the secretary at the Passmore Edwards Museum.

Records sent to me for the Surrey part of our area will be copied to that scheme. The project will be run in parallel with a similar tetrad mapping scheme for the Lepidoptera of Hertfordshire which is being conducted for the Hertfordshire Natural History Society by the present author. Accordingly, I now put in a plea for Hertfordshire records too!

Ideally records sent will conform in nomenclature and sequence to that given in J. D. Bradley's and D. S. Fletcher's *A Recorders Log Book or Label List of British Butterflies and Moths* (Curwen Press 1979, now published by Harley Books, Colchester), and should where possible include the Bradley and Fletcher code numbers, since this speeds computer entry of data considerably. Details are required only for unusual or uncommon species at this stage, although clearly grid references should be included if possible for all species.

At this point it is perhaps worth addressing some of the less experienced observers who run light-traps or otherwise make records which they very kindly send to me to add to the distribution maps. The growing number of moth-traps in operation around the area, particularly in the urban zone is indeed very pleasing, and I welcome all records. Many of these traps are run by member groups of various conservation bodies who, quite rightly, do not wish to collect moths from certain areas, preferring to release them after identification. This is a highly commendable attitude (although it is a rare event indeed when collecting affects the overall population of even the rarer species in a given area) and most of the larger moths as well as several of the micros can be readily identified on appearance. The recommended book is Skinner (1984) but beware of comparing picture with moth alongside the trap at night – ultraviolet light distorts colours considerably, and moths will look different again in the daylight. It should however, be pointed out that there are certain species-groups which regularly cause problems, and can only be separated by recourse to an examination of the genital apparatus, especially of the males. Accordingly these species, or at least one or two of them will need to be collected. I am more than willing to assist in this form of identification: The moths do not need to be 'set', they can simply be posted to me at my home address in a suitable container along with details of place and date of capture. The species groups concerned are:

November moth *Epirrita dilutata*
Pale November moth *E. christyi*
Autumnal moth *E. autumnata*

Common rustic *Mesapamea secalis*
Lesser common rustic *M. secalella*

Marbled minor *Oligia strigilis*
Rufous minor *O. versicolor*
Tawny marbled minor *O. latruncula*

Grey dagger *Acronicta psi*
Dark dagger *A. tridens*

Large ear *Amphipoea lucens*
Saltern ear *A. fucosa paludis*
Crinan ear *A. crinanensis*
Common ear *A. oculea*

Other species, particularly the pugs, and melanics of a variety of species, may also sometimes need such treatment. Much help for difficult species will be found in Skinner (1984), and for the pugs, B.E.N.H.S. (1981).

A number of other species may also require careful examination before committing their names to paper. For example, I receive a number of reports of the five-spot burnet *Zygaena trifolii* every year, but with few exceptions those which I or others have checked have turned out to be the far more common narrow-bordered five-spot burnet *Z. lonicerae.* Accordingly it is difficult to accept these 'critical species' records with any degree of confidence. Other 'difficult' pairs include the swallow and lesser swallow prominents *Pheosia tremula* and *P. gnoma* and the treble bar and lesser treble bar *Aplocera plagiata* and *A. efformata.* I am always happy to receive any specimens for identification from any area, provided that they are accompanied by locality data and a date of capture.

ADDRESS FOR RECORDS AND SPECIMENS: Colin W. Plant, 14 West Road, Bishop's Stortford, Hertfordshire CM23 3QP.

Book Review

Distribution and Status of Bats in Europe. By R. E. Stebbings and Francesca Griffith. The Institute of Terrestrial Ecology. 1986. 142 pp. £5.50 including postage and packing. ISBN 0 904282 94 5.

The format of this excellent little book is similar to that of the one dealing with woodlice reviewed elsewhere, which is not surprising as it originates from the same stable. Distribution and status of these interesting little animals throughout Europe is dealt with very well. There is a liberal sprinkling of black-and-white maps and photographs all through the book. It is recommended not merely to mammalogists, but to all interested in natural history.

R. V. Goulding

Survey of Bookham Common:

FORTY-FIFTH YEAR

Progress Report for 1986

General (G. Beven*)

Alfred R. Wilton, who jointly wrote the Survey's first paper on birds (1944), was 90 in May. He is keeping well and says 'I do most of the garden still'.

A. L. Panchen published in 1951 a paper on reptiles and amphibia. He is zoologist in the Department of Zoology, University of Newcastle upon Tyne, where he has recently edited The Systematics Association's Special Volume No. 15 on *The Terrestrial Environment and the Origin of Land Vertebrates* (1980. Academic Press, London). He wrote one of the papers in it – 'The origin of the relationships of the Anthrascosaur Amphibia from the late Palaeozoic.'

Nicola Penford B.Sc., M.Sc. assisted the late W. D. Melluish with counts of the birds of the Plains in 1976-7, and has now been appointed Assistant Conservation Officer, Surrey Trust for Nature Conservation.

An Open Day was held on 10 May, when 27 persons were present.

The Birches and Hundred Pound Wood were purchased by appeals by the Local Committee and officially handed over to the National Trust in August 1986.

The ecology of Isle of Wight Pond and Lower Eastern Pond (Andrew Merritt†)

An investigation into the ecology of Isle of Wight (IOW) Pond and Lower Eastern (LE) Pond was carried out from June to October 1986 to try to establish the factors responsible for the absence of aquatic vegetation in IOW Pond. LE Pond is eutrophic and may be regarded as a developed ecosystem with abundant emergent and aquatic flora, in contrast to IOW Pond.

Macroinvertebrate sampling of the two ponds was undertaken and a total of 30 species were found in IOW Pond and 26 species in LE Pond. However, application of the Shannon-Weiner diversity index revealed a higher species diversity in LE Pond, scoring 0.73 in contrast to 0.61 for IOW Pond. Species diversity is not just a measure of the number of species present, but is also a measure of species evenness. Thus five species, the bug *Plea atomaria,* water boatman *Notonecta* sp., water mites *Hygrobates* sp., and the small crustaceans *Daphnia* sp. and *Cyclops* sp. were dominant in IOW Pond, while 14 other species were represented by just one individual. LE Pond had marginally more even species distribution, but was still dominated by *Cyclops* sp., midge larvae *Chironomus* sp. and the freshwater shrimp *Gammarus pulex*. A score of below 1 is indicative of poor species diversity.

A number of physico-chemical parameters were measured, and mean readings are as follows:

	IOW Pond	*LE Pond*
pH	7.1	7.9
Total hardness (μg l^{-1})	179	221.5
Calcium hardness (μg l^{-1})	115	145
Conductivity (μmho cm^{-1})	454	503
Ammoniacal nitrogen (mg l^{-1})	6.3	9.8
Suspended solids (mg l^{-1})	29.3	43.0
Turbidity (FTUs)	21.8	8.6

(Note: μmho cm^{-1} = μS cm^{-1}. FTUs – Formazin Turbidity Units)

---

*16 Parkwood Avenue, Esher, Surrey KT10 8DG.

†33 Westmoreland Drive, Sutton, Surrey SM2 6AA.

Concentrations of suspended solids fluctuated widely and results were inconsistent. The high levels recorded from LE Pond were due largely to suspended organic matter, in contrast to IOW Pond where suspended solids consisted mainly of clay particles. Measurement of turbidity was considered to be more reliable. Thus the water from IOW Pond was notably more turbid, although the difference was not significant ($t = 0.435$ at 5 per cent significance level), due mainly to a high variance.

However, pH, total and calcium hardness, conductivity and ammoniacal nitrogen concentrations were higher in LE Pond associated with the eutrophic conditions. None of these variables was considered to be limiting factors in IOW Pond and were all at levels conducive to plant growth. The 10-year absence of aquatic flora from IOW Pond therefore remains unexplained.

Bryophytes (O. B. J. French*)

Once again, due to other commitments, I have been forced to miss far too many Bookham meetings. No species new to the Common have been discovered but, with Ella Hillman's never-failing help, eight new area records have been noted:

HEPATICAE	
Diplophyllum albicans	T
Frullania dilatata	P
MUSCI	
Campylopus pyriformis	M
Barbula unguiculata	T
B. fallax	OS
Homalothecium sericeum	M
Rhynchostegium riparoides	N
Plagiothecium denticulatum	T

Diplophyllum albicans has only been recorded previously from two other areas and *Rhynchostegium riparoides* is rare on the Common and has only been found before from Area O.

Vegetation: Willow Hybrids (K. Page†)

With the completion of 'Vascular Plants of Bookham Common: A New Survey' (Radcliffe and Page 1981) it was decided to investigate in greater depth the occurrence of hybrids in the area. Ten were listed in the Survey, three were considered to be lost and four gained. Those lost were *Fragaria* × *ananassa*, *Stachys* × *ambigua* and *Mentha* × *liliaca*. The additions were *Crataegus monogyna* × *C. laevigata*, *Endymion hispanicus* × *E. non-scriptus*, *Crocosmia* × *crocosmiiflora* and *Dactylorhiza fuchsii* × *D. praetermissa*. The remainder, *Tilia* × *vulgaris*, *Symphytum* × *uplandicum* and *Mentha* × *verticillata* were recorded by Jones (1951).

Willows – the genus *Salix* – which readily hybridize, are found in every division of the Common and five species have been named. A thorough search was made in 1986, resulting in the discovery of four hybrids.

One of the most conspicuous is the cross between a variety of the white willow *Salix alba* var. *vitellina* and the crack willow *Salix fragilis* which has produced the form *basfordiana*. This has shining, bright-orange twigs during the winter months that look particularly impressive against dark sombre skies. These occur on both sides of Central Ditch in divisions R and S.

*127 Bramley Way, Ashtead, Surrey KT21 1RB.

†10 Cannonside, Fetcham, Leatherhead, Surrey KT22 9LE.

The eared willow *Salix aurita* is rare on the Common and grows in a very damp area of division F. It has, however, hybridized with the most abundant species here, the sallow *Salix cinerea* ssp. *oleifolia*. Three plants determined as this hybrid were discovered on Bayfield Plain in division Q.

Among the indigenous species, the goat willow *Salix caprea* is the first to flower. The male plants producing their bright-yellow, *Mimosa*-like, catkins in early spring. The goat willow is slightly less widespread than the sallow, but it was confidently expected that hybrids between these two would not be hard to find; this expectation was not realised. Of the many specimens sent for identification one only was determined as *Salix caprea* × *S. cinerea* ssp. *oleifolia*. It is to be seen on the edge of the main footpath from Bookham Station to Isle of Wight Road in division R,846.

Salix viminalis is probably the best known osier. Its long narrow leaves with very silvery undersides make it easily identifiable. More importantly, it has the distinction of hybridizing with many of our native willows. Here it has hybridized with the sallow, but the offspring is now a very old and dying tree. It can be found in division D.

The herbarium specimens were determined by R. D. Meikle (Kew).

References

JONES, A. W. 1951. The Flora of Bookham Common. *Lond. Nat.* **33:** 25-47.

RADCLIFFE, B. and PAGE, K. 1981. Vascular Plants of Bookham Common: A New Survey. *Lond. Nat.* **60:** 68-84.

Fungi (Pamela Goldsmith*)

The following species, with the exception of one, all new to Bookham Common, were found during 1986:

Laetiporus sulphureus on oak
Stereum rameale
Tricholomopsis platyphylla
Hypoxylon fragiformis, also recorded in 1969
Peziza praetervisa on burnt ground
Calocera cornea
Calocera viscosa
Mycena clavulens
Lactarius rufus

The help of Kew with the identification of some of the more difficult species is gratefully acknowledged.

Hirudinea (G. Beven)

The medicinal leech

Two medicinal leeches *Hirudo medicinalis* were found clinging to metal rubbish in the Isle of Wight Ditch 8854 on 25 April 1986 (I.S.). This leech was last found by E. W. Groves on 12 March 1961 in the Isle of Wight Pond.

Lepidoptera (G. Beven)

A male purple emperor *Apatura iris* was seen in Central Wood 591 (A.M.) on 9 July and another was on horse-dung along Hollow Path on 12 July (per E.W.G.).

---

*14 Mayfield Road, Wimbledon, London SW19 3NF.

On 6 July five white admirals *Ladoga camilla* were seen in Eastern Wood, two in Central Wood and one on Central Plain (A.M.). Ringlets *Aphantopus hyperantus* were abundant on Isle of Wight and Bayfield Plains on 6 and 13 July, often flying among flowers of creeping thistle *Cirsium arvense* (A.M., E.W.G.). At least four gatekeepers *Pyronia tithonus* were frequenting a ride in Central Wood, area F on 13 July (E.M.H.).

Amphibia (I. Swinney)

On 17 June a school party dipping in Crater Pond 466, netted 40 newts, including both smooth *Triturus vulgaris* and palmate *T. helveticus*. All the newts were immediately returned to the pond (I.S.).

Reptilia (G. Beven)

The Grass Snake

The grass snake *Natrix natrix* is still numerous on Bookham Common. Panchen (1951) regarded it as quite common and sixty records for the period 1948-1967 were summarised by Beven (1968). Since then there have been 68 further records, making a total of 128. The earliest records in the year were in March, 11th 1969, 12th 1961, and 14th 1943. The latest in the year were in October, 8th 1967, 9th 1955, 11th 1953, 14th 1985 and 25th 1977. Although the different habitats were not searched equally intensively, the distribution of the snakes is of interest. Fifty records were in ponds or in nearby wet herbage (16 of these were of snakes swimming in the water), 39 were in grassland scrub, and 36 were in dense woodland. It is not always appreciated that grass snakes are quite common in damp woodland. The locality of two records was not given. A probable grass snake was seen held in the claw of a flying carrion crow *Corvus corone* by E. F. Youngman. Sloughed skins were found in June (1), July (2), August (1), and in October (1). The lengths of 11 (estimated or measured) were 15cm (6in) (dead), 22.5cm (9in), 30cm (12in), 45cm (18in), 2 at 50cm (20in), 2 at 60cm (24in) (1 dead), 67.5cm (27in) and 2 at 90cm (36in) (N.D., I.S., E.F.Y.). Ten were found dead, the causes of death being unknown except in the case of two, one had been the victim of a scrub fire in 1956, and in 1969 one was accidentally killed by a tractor (E.F.Y.).

When in the water the grass snake swims strongly with side-to-side movements of the body, holding the head well clear of the water. When a snake swam to a clump of willows with a branch on the surface of the water, it slithered over the branch and swam on the other side without slowing up at all. Another one swam to some willows and climbed about two feet up a stem, then slithered down and disappeared among the willows. As previously described (Beven 1968), on 9 May 1954 one was seen swimming in the Isle of Wight Pond for several minutes, with its head well out of the water, holding in its mouth a frog with a leg waving: it was swallowed after a short struggle (E.W.G.). One was watched in Sheepbell Pond, apparently lying in wait for newts, while floating in open water or hidden among weeds on 18 May 1977. The snake was caught and found to be a young male, rather slim and in need of food. When released it immediately returned to the water and hid among the weeds as before (Stiles 1978).

References

BEVEN, G. 1968. *Lond. Nat.* **47:** 91.

PANCHEN, A. L. 1951. *Lond. Nat.* **30:** 42-44.

STILES, D. 1978. *Lond. Nat.* **57:** 64-65.

Birds (G. Beven)

Population Studies in Oakwood, Scrub and Grassland

Owing to lack of observers, it was not possible to carry out the breeding season censuses in these three habitats during 1986. This is only the second year since 1950 in which a census of one of these areas has not been done.

Birds in 1986

During May a heron *Ardea cinera* built a nest by Upper Eastern Pond in a 15 foot high willow. However, it was mobbed by carrion crows *Corvus corone* and the adults deserted and no eggshells or young were found (A.P., I.S.). The heron is normally colonial, but single nests are not uncommon (Cramp and Simmons 1977). On 26 April a nightingale *Luscinia megarhynchos* was singing on Western Plain 453 (I.S.).

Laniidae

The red-backed shrike *Lanius collurio* has probably nested on Bookham Common for many years; they certainly nested in 1934 and the pre-war population was 3-4 pairs (Peakall 1960). They bred in 1940-41, while in 1942 three pairs bred in sq. 43, 44, 45, 46, 81 and 88, and in 1943 there were 3-4 territories in 765, 815, 873 and 891 on the wet grassy plains on the west of the Common (T.L.B., H.J.B., Carrington *et al.* 1944). There were also three nests in 1944 in sq. 45, 87 and 88, one in 1945, two in 1946-47, and one pair nested on Central Plain in 1948, '49, '50, '52, '53 and '55 (G.B., P.W.E.C., R.W.H., W.D.M., W.R., J.S.W., A.R.W.). There was a female in 1959, a pair nested in 1963 and again in 1964 in sq. 42-45 (G.B., M.G., N.G., F.C.R., W.D.M., *Lond. Bird Rep.* for 1963). There was an unmated male in 1965 (G.B., E.M.H., L.M.) but none has been seen since.

They often perched on the tops of hawthorn bushes, in small ash trees, on the top of tall Lombardy poplars, or even high up (60-70ft) on dead branches of elms. They were frequently seen making flycatching sallies. Family parties were seen being mobbed by a song thrush *Turdus philomelos*, a whitethroat *Sylvia communis*, willow warbler *Phylloscopus trochilus* or yellow hammer *Emberiza citrinella*. A larder containing various Hymenoptera and beetles was observed very close to a nesting site (T.L.B., Carrington *et al.* 1944). On 21 May 1949 a male was singing, a rarely heard, rambling song, rather like that of a linnet *Acanthis cannabina*, with some clear sweet repeated thrush-like notes (P.W.E.C.).

The number of red-backed shrikes has declined in Britain in the last hundred years or so, especially since 1940. The reasons remain obscure. Perhaps the colder, wetter summers and mild, wet winters led to smaller numbers of large flying insects, e.g. beetles and bumble-bees and hence to a decrease in shrikes which specialise in preying on them. However there does not seem to be any documentary evidence of a shortage of these insects (Peakall 1962). However, it has since been pointed out that after a series of poor summers and severe winters early in the nineteenth century many species of butterflies went into a decline. Then from 1920 to 1950 the population of most butterflies recovered, coinciding with a succession of warm summers and drier, colder winters. Since 1950 the uncertain climatic conditions may have been partly responsible for a further rapid decline, and although there has been some recovery, there is a continuing scarcity of some migrant butterflies (Burton 1975). These conditions may also have affected other insects.

On 26 and 27 May 1951 a woodchat shrike *L. senator* was seen on the Common by A. R. F. Hills and E. Giles (*British Birds* **45:** 258, 1952).

Three great grey shrikes *L. excubitor* have occurred since the Survey began. On

9-10 April 1944 a male ranged over Central and Bayfield Plains from one hawthorn to another, dipping almost to the ground and then rising to perch (A.R.W.). One was seen on 2 April 1945 (R.W.H.). On 12 March and again on 9 April 1967 on Central and Western Plains, one would perch on the very tops of oak saplings or hawthorn bushes (G.B.). It was silent throughout. A blue tit *Parus coeruleus* moved restlessly nearby with erected crest.

Bombycillidae: Waxwing

A party of some 20 waxwings *Bombycilla garrulus* stayed on Central Plain from 27 March to 12 April 1959. The birds perched on the branches of hawthorn or rose bushes and picked off the haws and hips, and swallowed them whole. By this date in early spring the haws were rather dried and withered. One bird selected the haws carefully, and after picking them, it seemed to 'feel' them in its bill and dropped many, only swallowing about one in four. The rose-hips were also swallowed whole and this was sometimes difficult, one bird had to make five attempts with a large hip before it was swallowed. Often the hips and haws would be carried off in the bill to a branch of a nearby tree and eaten there. Birds would frequently hover by these bushes, showing well the yellow band at the tip of the tail, before alighting to take the fruit, as if they were selecting the spray of fruit. Several birds would also perch repeatedly on the twigs of a large willow tree and eat the newly opening leaf buds (see also *Lond. Nat.* (1964) **43:** 92, 104). They could at times make flycatching sallies from high up on a horse chestnut, returning to the same tree. While resting in the elm trees one or more would often fly down to small puddles of water in among rough grass and drink. Each drink was interrupted two or three times, by raising the head so that the water could be swallowed. Then at close range some water could be seen dripping out of the bill. Sometimes while drinking some weed was picked up and this had to be tossed aside. Between bouts of feeding the birds collected together on the twigs of the elms and would often keep up a fairly continuous trilling, resembling the trilling of a tit or the shaking of a small silver bell. They would also make this trill as they flew about in small parties. Another note often heard from resting birds was a soft 'chirp' or 'chirrup'. Several 'pairs' were seen to bring their bills together, as if for courtship feeding, but no food was transferred. Sometimes display followed as when two came together side by side on a branch, with rump feathers erected to form almost a grey 'powder puff', followed by some 'billing', with the crest fully erected (G.B.).

Fringillidae: Linnet

The plains of Bookham Common before 1925 (when the National Trust took over) are described by W. H. Spreadbury (1957) – 'The Central Plain and those areas on the western side of the Common, where cattle frequently grazed were less wet, and the grass was mostly short though hawthorn bushes were not infrequent especially in the Isle of Wight and Western Plains. There was little blackthorn and, of course, grazing checked the growth of scrub. The slopes immediately along the western edge of South-east Wood were thickly covered with dwarf gorse and heather and were without trees, except for a few saplings near Hollow Wood'. It sounds like a suitable habitat for linnets *Acanthis cannabina* and it is perhaps surprising that Spreadbury does not mention any, and Carrington *et al.* (1944) state 'Not often recorded, but a flock of 20 was seen in February 1943'. However, A. R. Wilton did note that on 26 June 1943 one was perched and calling 817, and there were many in the Central Plain area. Also P. W. E. Currie found a family party at 735 on 25 July 1948, and watched a nest with four young at 8486 in April-May 1949. By this time the Western Plains area was described thus: 'The alluvial belt is marshy, and at times waterlogged. The remainder of the area is drier and better drained, mainly grassy, with scattered hawthorn and bramble bushes and blackthorn clumps, and some bracken on higher ground' (Currie 1950). As far as the plains are concerned gorse *Ulex europaeus* was at this time described as 'occasional by hedges and in grassy places' and dwarf gorse *U. minor* as 'occasional on plains; locally frequent' (Jones 1954). Jones also wrote that of the commoner species of the scrub on the plains, holly and blackberry were abundant, rose frequent, blackthorn and hawthorn locally dominant, and birch occasional.

Linnets with young were noted in 1953 (G.B.) and small numbers of linnets were seen on 61 acres (24 ha) of the plains during the summers of 1954-59 (Melluish 1960) and in 1962 a regular census of birds on the whole of 96 acres (39 ha) of plains was begun (Melluish 1969, G.B., D.A.B., W.D.M.). From 1962 to 1971 the number of territories of linnets was 1, 1, 1, 4, 4, 4, 1, 2, 0, 1 and from 1972 to 1985 was 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0.

Why have the linnets disappeared? The habitat in the breeding season is especially gorse-grown commons and rough uncultivated ground with a sprinkling of bushes and scrub, or young plantations; to a less extent, gardens, hedgerows, and bushy places amongst cultivation (Witherby 1938). 'The linnet breeds on any open ground with low scattered bushes,...' (Newton 1972). On Bookham Common there seems therefore no obvious reason for the loss of linnets. However Bookham Common has farmland on the north and west sides, and, on farms with cereal crops, the major cause of the decline in linnets seems to be the use of herbicides, which have been used more extensively since 1970, especially in the present decade; decreasing trends began in 1977 or earlier. This concerted attack on the linnet's main food supply (the seeds of broad-leaved weeds) has resulted in their present steep population decline (Marchant and Whittington 1986).

Emberizidae

In the 1930s several pairs of yellowhammers *Emberiza citrinella* nested along the gorse-covered slope of Central and Western Plains (Spreadbury 1957) and nesting also occurred in 1942 3, '43 5, '44 4, and '45 7 territories (Carrington *et al.* 1944, A.R.W.). Since 1947 counts have been made in most years of the number of territories on Central, Bayfield, Isle of Wight and Western Plains 39 ha (96 ac), but in those years enclosed in brackets no census was made on Central Plain, so that the area studied was then only 24 ha (61 ac). The results were as follows: 1947 7, '48 11, '49 7, ('50 5), ('53 6), ('54 7), ('55 4), ('56 5), ('57 3), ('58 5), ('59 4), '63 6, '64 9, '65 7, '66 9, '67 7, '68 8, '69 7, '70 5, '71 8, '72 7, '73 4, '74 5, '75 2, '76 2, '77 3, '78 3, '79 4, '80 2, '81 2, '82 0, '83 0, '84 0 and '85 0 (G.B., D.A.B., P.W.E.C., D.V.F., W.D.M.).

In 1950 these plains consisted of an alluvial belt along Bookham Stream which was marshy and at times waterlogged, and a larger, drier and better drained area, mainly grassy, with *Deschampsia cespitosa* dominant, and with scattered hawthorn, dog rose and bramble bushes, blackthorn clumps and some scattered areas of bracken on the higher ground (Currie 1950). The grazing of cows, with some horses, sheep and geese, had been gradually discontinued, especially when the National Trust took over in 1925-6, but continued on a small scale until about 1950. There was then a steady increase in the growth of scrub and after rabbits had been almost exterminated by myxomatosis in 1954, the growth of shrubs was further accelerated. Between 1952 and 1956 the scrub had increased 5-10 times, the area covered by oak canopy 12 times and the number of hawthorn bushes by 20-50% (Castell 1956, 1960 and *in litt.*). Since 1959 12 ha (30 ac) of grassland have been partially cleared of scrub, averaging 1 ha (2½ ac) per year. The total being nearly a third of the 39 ha (96 ac) of the main scrub-grassland. The shrubs, although fewer, are now larger and some are even thickets, with small trees, including many young oaks, and there are extensive tracts of bracken where the ground slopes gently upwards to Central Wood (Melluish 1960, 1969).

In 1965 and from 1968 to 1971 there were one or two territories of yellowhammers on Eastern Plain. These birds may well have spread from the Central-Western Plains area, where in 1964 there were nine territories, but from 1973 they were decreasing from 4-5 to nil territories. Eastern Plain, of about four hectares (10 ac), was a typical wet heathland on sandy and rather acid soil in 1950. Later it was invaded by birch, aspen and bracken, which covered most of the area by 1968, overgrowing much of the once dominant purple moor grass *Molinia coerulea.* During 1969 the bracken on two hectares (5 ac) was cut by rotary cutter four times in spring and summer, and again in March and August 1970. The purple moor grass spread rapidly in place of the weakened bracken, and some birch and aspen were also cut. The drier climate and better drainage of latter years have possibly allowed it to become a dry heath association. The clearing has made the area more attractive to the public with their dogs, producing disturbance to ground-nesting birds. Also from 1966 to 1968 there were 1-3 territories in Eastern and Western Hollows, but apparently not subsequently, again probably a spread from the Central-Western Plains area (G.B., E.M.H., F.C.R., P.S.).

The habitats of yellowhammers in the breeding season are grasslands, arable farmland with hedgerows, heaths, commons, bracken-covered hillsides and even woodland edges. Batten (1971) points out that they breed in some numbers in forestry plantations up to the first 15 years of growth in southeast England. However, they avoid areas in which the scrub has become too dense or there are too many trees (Sharrock 1976, Witherby 1938). Nesting occurs in hedge bottoms, gorse coverts, by roadsides, plantations of young trees, at the foot of bushes, generally on or near the ground (Witherby 1938).

Thus it is not clear why yellowhammers have disappeared from Bookham Common. Perhaps it is because there are now too many trees and shrubs, or even too many people and dogs disturbing the nests on the ground. The food of the yellowhammer consists largely of grain, but also seeds of weeds, wild fruits, leaves, grass, etc. It may be that herbicides have reduced the seeds of broad-leaved weeds on neighbouring farms; see the section on linnet. There is also another factor. In recent years there has been a gradual adaptation by the reed bunting *E. schoeniclus* to occupation of a drier habitat, sometimes competing with the yellowhammer, with the disappearance of the latter in at least one locality (Minton 1971). In the Central-Western Plains area on Bookham Common the number of reed bunting territories increased from about 1962, so they may well have had some influence on the number of yellowhammers. Perhaps a combination of all these changes has caused the disapperance of the yellowhammer.

Reed buntings *Emberiza schoeniclus* have nested at least since 1942 (Carrington *et al.* 1944) and are usually restricted to the alluvial belt, along the course of the ditches and streams. Territories were mapped on Western, Isle of Wight, Bayfield and Central Plains, and round the Isle of Wight Pond, an area of about 40 ha (98½ ac) except in those years enclosed in brackets, when no census was made on Central Plain and the Isle of Wight Pond, so that the area studied was only 24 ha (61 ac). These years were, in 1943 2, '44 2-3, '48 2-3, '49 2, '50 2, ('55 2), ('56 2), ('57 4), ('58 3), ('59 4), '62 5, '63 3, '64 3-4, '65 3, '66 5, '67 6, '68 5, '69 4, '70 3, '71 5, '72 5, '73 4, '74 4, '75 5, '76 3, '77 2, '78 3, '79 3, '80 0, '81 2, '82 1, '83 1, '84 4, '85 1 (Melluish 1960, 1969, L.B., G.B., D.A.B., P.W.E.C., D.V.F., K.G., R.G., E.M.H., R.K., L.M., W.D.M., F.C.R., B.A.R., M.S., A.R.W.). In addition there was one territory by Lower Eastern Pond in 1950 (P.W.E.C.) and by Western Hollow Pond in 1984 (L.M.), and nesting occurred on Eastern Plain in 1965 (C.P.C., L.M.).

In the last 20 years or so the plains have become rather drier and as already stated reed buntings have gradually become adapted to a drier habitat, e.g. dry scrub, possibly in competition with yellowhammers (Sharrock 1976). They may therefore have partially occupied areas now deserted by yellowhammers. This has occurred in at least one English locality, where the reed buntings increased and the yellowhammers disappeared, as at Bookham (Minton 1971). In the plains and the Isle of Wight Pond area at Bookham Common the reed bunting increased from 2-3 territories in 1943-56 to 3-6 territories in many years from 1957 to 1984. Reed buntings feed mainly on the seeds of marsh plants, grasses and grain, so presumably have not been affected, if at all, by herbicides on neighbouring farms.

A corn bunting *Emberiza calandra* was singing from the top of a tree inside Central Wood 535 on 2 August 1967 (G.C., K.G.).

A pair of cirl buntings *Emberiza cirlus* was seen on 27 April 1940 (Carrington *et al.* 1944).

References

BATTEN, L. 1971. *Birds of the World* (Ed. J. Gooders) I.P.C., London. Yellowhammer: 2453-55.

BURTON, J. F. 1975. *Bird Study* **22:** 203-204.

CARRINGTON, L. I., CASTELL, C. P. and WILTON, A. R. 1944. *Lond. Nat.* **23:** 23-29.

CASTELL, C. P. 1956. *Lond. Nat.* **35:** 9-10.

CASTELL, C. P. 1960. *Lond. Nat.* **39:** 64.

CRAMP, S. and SIMMONS, K. E. L. (Eds). 1977. *The Birds of the Western Palearctic.* **1:** 310.

CURRIE, P. W. E. 1950. *Lond. Nat.* **29:** 92-97.

JONES, A. W. 1954. *Lond. Nat.* **33:** 25-47.

MARCHANT, J. and WHITTINGTON, P. 1986. 1984-85 CBC Index Report *B.T.O. News* **146:** 7-10.

MELLUISH, W. D. 1960. *Lond. Nat.* **39:** 89-98.

MELLUISH, W. D. 1969. *Lond. Nat.* **48:** 135-142.

MINTON, C. 1971. *Birds of the World* (Ed. J. Gooders) I.P.C., London. Reed Bunting: 2480-2484.

NEWTON, I. 1972. *Finches.* Collins, London.

PEAKALL, D. B. 1960. *Surrey Bird Rep.* **8:** 30-32.

PEAKALL, D. B. 1962. *Bird Study* **9:** 198-216.

SHARROCK, J. T. R. 1976. *The Atlas of Breeding Birds in Britain and Ireland.* B.T.O., Tring.

SPREADBURY, W. H. 1957. *Lond. Nat.* **36:** 54-57.

WITHERBY, H. F. *et al.* 1938. *The Handbook of British Birds.* **1.** Witherby, London.

Mammals (G. Beven)

Two foxes *Vulpes vulpes* on 20 January were fighting over territory in Hill House Wood 545 (I.S.). On 20 December there was some activity in the badgers' *Meles meles* sett in the northern part of the Common (I.S.). Roe deer *Capreolus capreolus* were again often seen, one was observed six times, two were seen three times, an adult with two juveniles once, and three adults and two juveniles once (A.P., K.P., I.S., B.R.R.). A kid was found dead in Eastern Wood on 8 June by Pamela Goldsmith. From the marks on its neck, it had probably been killed by a large dog. It was still well spotted on the lower back and flanks, so presumably was less than six weeks old.

Brown Hare

The brown hare *Lepus europaeus* seems to be present throughout the year in very small numbers, perhaps more numerous in May. Between 1961 and 1980 there have been 44 records. The monthly figures were January 3, February 1, March 2, April 4, May 12, June 5, July 2, August 1, September 0, October 3, November 4, December 5 (two records – month unknown). In most years during this period there have been only 0-3 records (once 5) but in 1970 there were 12 sightings. Barnes and Tapper (1986) found that exceptionally large numbers of hares were shot on an estate in East Anglia in 1970 (and also in 1971), but not as many as in the years 1960-62. They suggest that the increase in vegetation cover which followed the reduction in rabbit *Oryctolagus cuniculus* grazing pressure, after the myxomatosis epizootic in 1953, might have resulted in higher leveret survival. There have been 44 records during the period 1961-1980 in which hares have been noted in most parts of the Common but 31 were seen in oakwood. Corbet and Southern (1977) remark that their presence in woodland is perhaps mainly for shelter rather than feeding. A newborn leveret was found in Hill House Wood on 8 August 1948 (G.B., P.W.E.C.). Litters may be born at any time of the year, but mainly in April.

References

BARNES, R. F. W. and TAPPER, S. C. 1986. *Mammal Review* **16:** 111-116.

CORBET, G. B. and SOUTHERN, H. N. 1977. *The Handbook of British Mammals* P. 142.

Observers: L. Baker, T. L. Bartlett, G. Beven, Suzanne Beven, D. A. Boyd. J. H. Bratton, Evelyn P. Brown, H. J. Burkill, J. A. Burton, C. P. Castell, G. Chuboyzk, S. H. Chalk, P. W. E. Currie, N. Davies, E. M. Forsyth, O. B. J. French, D. V. Freshwater, K. A. Gold, Margaret Goom, Norah Goom, R. Griffiths, A. E. Le Gros, E. W. Groves, Clare Harding, R. W. Hayman, J. Hearn, Ella M. Hillman, A. M. Hutson, R. H. Kettle, P. W. King, D. Macer-Wright, L. Manns, P. C. Le Mesurier, W. D. Melluish, A. Merritt, P. A. Morris, C. Nunn, K. Page, L. Parmenter, L. G. Payne, A. C. G. Poore, B. Radcliffe, F. C. Reeves, B. A. Richards, J. E. Roberts, Miss M. E. Robins, Dorothy Rook, W. Ruttledge, A. Stevens, E. Stevens, D. Stiles, P. J. Strangeman, M. Swinburne, I. Swinney, Margaret M. Taylor, A. S. Thorley, M. Towns, Mary Waller, Audrey E. Warren, J. S. Wightman, A. R. Wilton, D. A. Yalden, E. F. Youngman.

Book Review

Animal Folklore, Myth and Legend. By Anthony Wootton. Blandford Press, Poole. 1986. 160 pp. £8.95. ISBN 0 7137 16177.

Despite its modest size, *Animal Folklore, Myth and Legend* contains a striking profusion of fiction, fact and comment. Plants excepted, 'any living organism' is seen fit for inclusion. Attention is given to the attributes, misconceptions, fears and speculation associated with a wide range of creatures and to improbable cures and palliatives concocted from their remains. Folklore is treated more fully than either myth or legend. The whole is naturally 'licked into shape' – from the quaint notion that bears must actually lick their cubs into acceptable bear-like form. The author, Anthony Wootton, is an entomologist, formerly editor of B.N.A.'s *Countryside* magazine.

Side headings divide each chapter. English equivalents accompany Latin names. An indifferent index offers Androcles, but not the lion, the latter found only under 'Mammals', among references to sundry other species. Bernard Levin's inclusion as an arachnophobe is an unlikely entry. Illustrations are in black and white, small, and carefully executed by the author. A hedgehog spiking apples is copied faithfully from a priceless B.M. bestiary.

Mr Wootton describes his book as 'one for the naturalist who is interested in folklore'. The general reader can be invited to show an equal appreciation. Dragon and unicorn, brightly-coloured on its attractive dust-jacket, serve well to catch the public's eye.

Stella Luce

Population Dynamics of Damselflies at Bookham Common

by RUTH DAY*

Summary

Zygoptera populations at three Bookham Common ponds were estimated using capture/mark/recapture of adults during the summers of 1985 and 1986. One of the ponds, South-East Pond, was investigated monthly during the winter of 1985/6 for Odonata larvae. The azure damselfly *Coenagrion puella* was found to be twice as abundant as any other zygopteran adult. Only two species of larva were found, of which the most abundant was *C. puella* and the other, which was well represented, was the southern hawker dragonfly *Aeshna cyanea*. Data are presented on the lifespan of *C. puella* males and fluctuations in the observed populations of adult Odonata are discussed.

Introduction

The aim of the two previous surveys of Odonata at Bookham Common (Payne 1945 and Bratton and Langlois 1984) was to record all the species found on the Common and to describe their distribution. Neither survey included any work on the larvae, though Payne (1945) regretted that practical difficulties prevented larval observation. The present work had the different aim of estimating the population sizes of the more common species at three of the ponds by marking and recapturing adults and looking for larvae.

A group of five large ponds runs from east to west across the middle of Bookham Common. Bratton and Langlois (1984) found that though dragonflies had been observed at all five, only one of them, Lower Eastern Pond (Map ref. TQ130563) was a particularly good site. They also surveyed two other permanent ponds: South-East Pond (TQ131560) and Sheepbell Pond (TQ133569). These three ponds were selected for the population study.

Management work was carried out at both Lower Eastern and South-East Ponds in 1976/77. In July 1976 Lower Eastern Pond was partially cleared of scrub and broad scraped margins were left on the northern and southern sides (Radcliffe 1978). The pond was temporarily drained in April 1977 in order to deepen it. Also in 1977 South-East Pond was cleared of overhanging trees and opened up (Beven 1978). As Bratton and Langlois (1984) say, these are the two best dragonfly ponds 'probably due to the hydrosere…being at an early stage'.

Spreadbury (1956), recalling Bookham Common before the first world war, writes that Sheepbell Pond was in a dense wood and not always easy to find but that 'here on several occasions we caught some fine tench'. It is still in dense woodland, overshadowed by some fine old oaks *Quercus robur* and a large beech *Fagus sylvaticus*. Payne (1945) found no dragonflies there despite the fact that it was in those days one of the few permanent ponds on the common. He described it as probably too stagnant for dragonflies to breed. Within the last ten years, however, it has been partially dredged by a group of scouts hauling on an old bathtub (I. Swinney: personal communication) and Bratton and Langlois (1984) record finding the southern hawker *Aeshna cyanea*, and the large red damselfly *Pyrrhosoma nymphula* at this pond.

Adult damselflies were marked and recaptured in the course of 16 visits to Bookham Common during July and August 1985, and nine visits in 1986, four in June and five in August.

It very soon became apparent that damselflies and dragonflies would be found only at Sheepbell Pond on sunny days. At South-East and Lower Eastern Ponds, the damselflies often settled on the reeds during overcast and light drizzle. In these conditions there was no sign of them at Sheepbell Pond, where there is heavy shade and there is very little marginal vegetation. Unfortunately there was a great deal of wet cloudy weather during the summer of 1985, so on nine of the sixteen visits, it was only possible to sample the other two ponds. In 1986, therefore, the main aim of the June visits was to establish the size of the large red *Pyrrhosoma nymphula* population at Sheepbell Pond.

---

*18 Zenoria Street, East Dulwich, London SE22 8HP.

The method of marking and releasing adults for subsequent recapture was chosen because it seemed likely to yield the most accurate results. Parr used mark/recapture techniques to study populations of damselflies at Dale, Pembrokeshire (Parr 1965) and at Dunham Park, Cheshire (Parr and Palmer 1971; Parr 1973, 1976). This method is quite suitable for damselflies (Zygoptera) which congregate in large numbers near ponds and have only weak powers of flight, but it soon became apparent that it was useless for dragonflies (Anisoptera) which are not very easy to catch in a butterfly-net and which, in any case, do not congregate in large numbers at the relatively small water bodies on Bookham common.

The orginal intention was to look for larvae by netting at regular intervals at all three ponds. Due to practical difficulties, however, only South-East pond was at all thoroughly sampled.

Methods

1. Adults

Parr (1965, 1973, 1976) had used quick-drying paint to mark damselflies, but he found (1965) that approximately 1% of the insects captured were injured by this method and so he did not release them. He writes (1965) that 'many individuals (not all) at first attempted to remove the paint from the wings by rubbing movements of the abdomen. If paint was applied too thickly or as too large a spot, there was a tendency for it to become smeared on the sides of the abdomen. The successful application of a small mark necessitated frequent cleaning of the marking wire and thinning of the paint.'

It was clear from this that the quick-drying paint method would be very inconvenient if it were necessary to wade into the pond when catching the insects. Parr's experience also suggested that it caused avoidable mortality and stress, so an urgent search of the literature was made to find a better method of marking.

Hinnekint (1974) wrote 'Odonata are captured 10-20 at a time, using a butterfly net. They are removed from the net by grasping the top of the closed wings between thumb and fingers, and then transferred to the other hand to hold them with head and thorax between thumb and two fingers. The wings may then be held against a solid surface to be marked by a second person on the underside of one hindwing using a sharp pointed waterproof magic marker. The animals are released immediately thereafter. Using only one wing avoids the necessity to spread the wings at recapture.' Hinnekint pointed out that while it is not possible to write figures on damselfly wings, it is quite easy to draw dots and dashes. He worked out a numbering system on this basis, and a variation of his system was used.

Hammond (1977) suggested that a white nylon butterfly net was 'quite suitable for capturing damselflies and most of the large dragonflies; but the darter dragonflies...are easily startled when approached by anything white, so it is advisable to use a black net to ensure success.'

A black butterfly-net was used throughout the study at Bookham, so no comments can be made on the suitability of white nylon. The black netting used was very light weight, of the kind used for ladies' hats, and eventually it developed a number of holes, which had to be sewn up. It was found quite suitable for catching the few ruddy darter dragonflies *Sympetrum sanguineum*, which came within reach, as well as damselflies and a very few hawker dragonflies. A considerable advantage of the lightweight netting was that it was easy to see through. Thus it was possible to see immediately how many insects had been caught by a sweep of the net, what they were, and which way up they were. This made it easier to get them out without injury.

Following Hinnekint (1974) various marker pens were tried. Edding 400 permanent markers, which have 1mm felt tips, worked very well. Edding 3000 were also tried and found to have too thick a point. There is no evidence that any of the marked damselflies died as a result of this technique. Occasionally, the point of the pen pierced a wing, but the damselfly in question flew away quite normally, and was sometimes recaptured two or three weeks later. As the wings of older insects tend to have become rather ragged, a small hole in the wing membrane is probably an insignificant injury. No attempt was made to capture teneral insects. Their soft, transparent wings can easily be injured (Parr 1965, Hinnekint 1974).

Three different coloured pens were used: green for South-East Pond, blue for Lower Eastern Pond and red for Sheepbell Pond, to see if there was any movement of marked insects between the different ponds.

The method eventually adopted was to hang the three pens with their caps clipped on to a piece of string round the neck and then look for the damselflies. When they were found and netted, the open side of the net was held against the chest and the insects removed one at a time with the left hand. If there was more than one insect in the net, the net was held against the body with the elbow, while the pen of the correct colour was pulled out of its cap with the right hand and used to mark the hind-wing. It was found that damselfly wings, even those of *I. elegans*, the smallest species sampled, were quite long enough to hold gently but firmly over the insect's back with the thumb and forefinger of the left hand, while reading previous marks, or writing on the end of the wing, which rested against the third finger of the left hand. After marking, the insect was immediately released. There was no indication that this procedure caused any stress.

As soon as the marked insect was released, a tally was kept, using the same marker pen. Initially this was written on the back of the left hand and subsequently cleaned off with methylated spirit, but later a small hardbacked notebook, fastened to the left forearm with elastic, was found more convenient.

Hinnekint (1974) clearly intended to suggest that each insect marked should be given a unique number, which would merely be read at each subsequent recapture. Through some mental oversight, I did not realise this until a substantial amount of work had been done marking insects with the date: one dot for day 1, two dots for day 2, etc. I therefore persisted with the dating system throughout the summer of 1985, though for a study as long as sixteen consecutive days, the unique number system would be preferable. For the five-day study in August 1986, the dating system was used again and was quite satisfactory for this shorter period.

Longfield (1949*b*) describes the best method of handling a dragonfly being to hold it by the wings, folded over its back, so that it cannot struggle and injure itself. Hinnekint (1974) added the important advice that dragonflies should not be handled with wet hands, as there is an enzyme in human skin which damages their wings. Every effort was made, during the summer to follow these recommendations, and as a result, there was only one known casualty.

Quite apart from anything else, the weather made it impossible to catch damselflies every day, so a means of processing the data which did not depend on recapture on consecutive days was essential. Two methods were tried, Jolly's stochastic method and the Manly/Parr method. Both are described in Begon (1979) and Blower *et al.* (1981). A program was written in BASIC for the BBC micro-computer to save all the labour of calculation, based on these authors' explanations, and tested on their examples.

Both methods require only the most recent marks on recaptured animals. Thus if a damselfly was marked on 29 July, recaptured and marked again on 1 August and recaptured again on 3 August, only the 3 August mark would be counted. Both methods have a so-called 'Z' category, which is the number of animals marked both before and after the day for which the population is being calculated, but not on it. The Manly/Parr method also includes a 'Y' category; animals captured on the day in question which were also captured both before and after. It also requires a higher sampling intensity than Jolly's method. The 'Y' categories obtainable from the Bookham data were very small indeed and so the Manly/Parr population estimates tended to peak whenever there was a drop in the numbers caught. This method was therefore rejected as unsuitable and only the Jolly estimates were used.

2. Larvae

South-East Pond and Sheepbell Pond were sampled by netting. It was very difficult to use a net at Lower Eastern Pond in 1985 because the water level was unusually high following the very wet summer.

Four sampling points were selected at South-East Pond. Samples were taken at each of these points on 28 September 1985, 20 October 1985 and 10 November 1985. The net was dipped twice at each point. It brought up a great deal of mud and dead oak leaves. Washing the catch through a large plastic kitchen sieve helped to get rid of the mud. Animals and leaves were then tipped into a large white plastic tray and the leaves and pond weed removed by hand. The animals captured were taken to the L.N.H.S. hut where they were identified with the aid of Macan's key (1959). All the animals were then returned to their pond with the exception of a few Odonata specimens which were preserved in formalin so that their identification could be checked later. Initially Gardner's (1955) key was used, but when it became available, McGeeney's (1986) key was preferred as larvae could more easily be identified without killing them.

Attempts to net Sheepbell Pond at the same time produced no animals.

Macan (1974) used artificial *Carex* made of polypropylene rope to sample invertebrates in Hodson's Tarn. His aim was to provide a uniform substrate to measure animals per unit volume, but incidentally he found that his artificial weed was very convenient to handle in that it produced more animals and less debris. His results show that Odonata larvae, present in Hodson's Tarn in large numbers, were the most numerous animals found on his artificial weed.

It might be difficult to sink a square lattice, such as that used by Macan (1974) through the very dense natural weed in the Bookham ponds. Accordingly a different design was tried, based on the spawning ropes used by Alex Behrendt to breed ornamental carp. These consisted of 230mm lengths of polypropylene string, plaited and knotted into a central rope and then frayed out to resemble weed. Behrendt (1977) in an account of how to catch invertebrates for fish food, describes an old fish farmer's trick of smearing a hessian sack with meat such that fragments of meat catch on the rough weave and then weighting the sack with stones and leaving it in a stream overnight.

Initially, three lengths of rope-based artificial weed were made. One end was tied to a net bag of stones and the other was weighted with one large stone. Both 'weed' and stones were smeared with minced liver to attract animals as prey for the predatory dragonfly larvae, and one length of artificial weed was sunk in each of the study ponds on 19 January 1986. The artificial weed was removed from Sheepbell and South-East Ponds on 26 January 1986. By this time, the ponds were covered by a 12mm layer of ice, and it was not possible to penetrate the reedbed to remove the 'weed' from Lower Eastern Pond.

The ponds remained frozen until March. On 9 March 1986, South-East Pond was netted through a hole in the ice. By 24 March 1986, the ice had melted, and

Sheepbell Pond was netted. On 1 April 1986, four lengths of artificial weed were sunk in Lower Eastern Pond, as described above. The original piece, placed there in January, could not be found. On 30 April 1986, a visit was made to Lower Eastern Pond to remove these four substrates.

Finally some fairly determined netting was done along the pond edge of the reedbeds on 19 November 1986, the water level by this time being much lower.

The Shannon index of diversity and the evenness index were applied to the samples taken, which apart from the newts were made up of macroinvertebrates. Arthure (1979) used the Shannon index for the plankton of Isle of Wight Pond and Lower Eastern Pond and it is briefly described in his paper. Basically its range is from 0 to 2.72, the higher the reading, the greater the diversity. The evenness index is the Shannon index of diversity divided by the natural log of the number of groups (or species) found. Its range is from 0: only one species present to 1: all species equally abundant.

Results

1. Adults

Six Odonata species were recorded at the study ponds in 1985 and individuals of two additional species were seen in 1986. (See Tables 1 and 2). Probably the main difference was the weather: 1985 was a very cold wet year, 1986 was somewhat better and included a period from 12 to 20 June during which there was no rain, ten hours sunshine on most days and temperatures averaged 18°C, rising to 23°C and not falling below 16°C (Wisley weather records).

In 1985 the marking and recapture of damselflies was attempted over a period of 43 days during which 17 visits were made to Bookham Common, one of which, on Sunday 4 August, was distinguished only by torrential rain and a total absence of Odonata. There were two survey periods in 1986: an early one in June, concentrating on *Pyrrhosoma nymphula* at Sheepbell Pond, and another made up of five visits over ten days at the beginning of August, concentrating on Lower Eastern Pond, with the aim of obtaining results comparable to the most productive part of 1985. The first visit in 1986 was made on 8 June, and there was no evidence of any Odonata having emerged at any of the study ponds. By the second visit on 17 June, male *Coenagrion puella* were sunning themselves at all three ponds and teneral *C. puella* were seen at both Lower Eastern and South East Ponds.

At all three ponds surveyed male *C. puella* greatly outnumbered adults of all other Odonata species put together. With the exception of two individuals in 1985, however, and one in 1986, female *C. puella* were found near a pond only in the act of mating.

Though quite common nationally, *Pyrrhosoma nymphula* is probably the rarest damselfly at Bookham Common, where it has been found recently only at Sheepbell Pond. In 1985, four males were captured and marked on 12 July. One of them was recaptured two days later, together with another previously unmarked male. They were never seen again and no females were found. In 1986, eight males and four females were found and marked on 17 June. One of the females was recaptured on 19 June and three of the males were recaptured on 25 June. No additional *P. nymphula* were seen on either of these days, suggesting that the total population was no more than 12 to 16 individuals.

Enough mark/recapture data were gathered in 1985 to calculate population estimates, using Jolly's method, for male *C. puella* at Lower Eastern Pond over 14 days and at South-East Pond over 12 days (Figure 1). At both sites, the population fluctuated round about the 200 mark, being slightly larger at South-East Pond. Complete mark/recapture population estimates for both years are shown at Table 3. The marked damselflies seemed to stay pretty close to their own pond. During

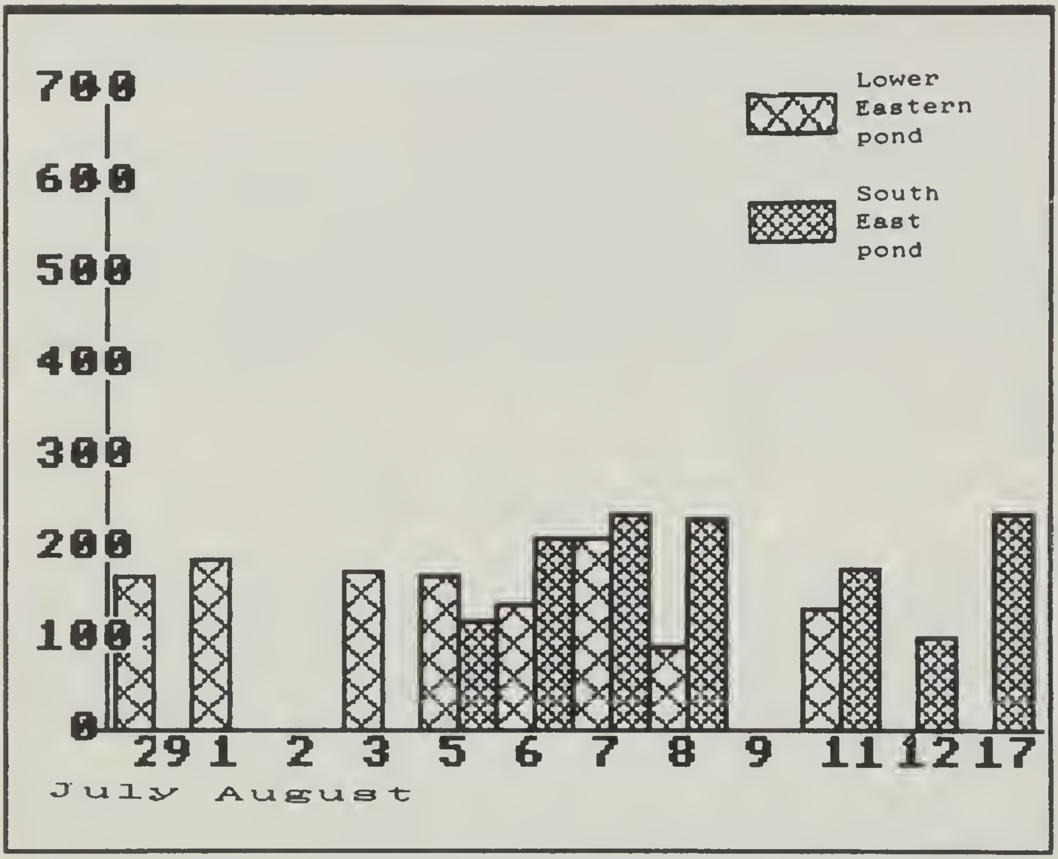


FIG. 1. 1985 population estimates using Jolly's stochastic method of male *Coenagrion puella* the azure damselfly at Lower Eastern Pond and South-East Pond.

the entire survey, only three individuals changed ponds. Those that did were marked at South-East Pond on 9 and 14 July and recaptured at Lower Eastern Pond on 1 August, 3 August and 29 July, taking respectively 23, 26 and 15 days to travel approximately 300 metres.

It was just possible to calculate similar population estimates for male *Enallagma cyathigerum* and *Ischnura elegans* at Lower Eastern Pond for two days each in 1985. These are graphed together with the equivalent *C. puella* estimate in Figure 2. The dips in the population graphs for *C. puella* and *I. elegans* at 5 and 8 August can be explained by the weather, which was overcast with drizzle. The graph suggests that *E. cyathigerum* took the opportunity to visit the pond while the other two species, especially *C. puella,* were less abundant. This is probably misleading as the numbers of the two less-common species actually captured show (Table 1). The truth of the matter is probably just that male *I. elegans* and *E. cyathigerum* were present during the first week of August. In any case, population estimates of both species were very low, having peaks of 66 and 80 respectively. *Lestes sponsa* also occurred at South-East and Lower Eastern Ponds in 1985, but in very small numbers.

In 1986, the population estimates for male *C. puella* at Lower Eastern Pond, though obtained over a much shorter period, are more than double the equivalent ones for the previous year. The two are compared in Figure 3. The peak of 609 at 9 August was caused by the beautiful weather on 8 August. There were 10 hours of sunshine and a temperature of 17°C. Of the 64 *C. puella* captured that day, 15 were recaptures.

Even more remarkable, however, is the balance of other species. Only three *E.*

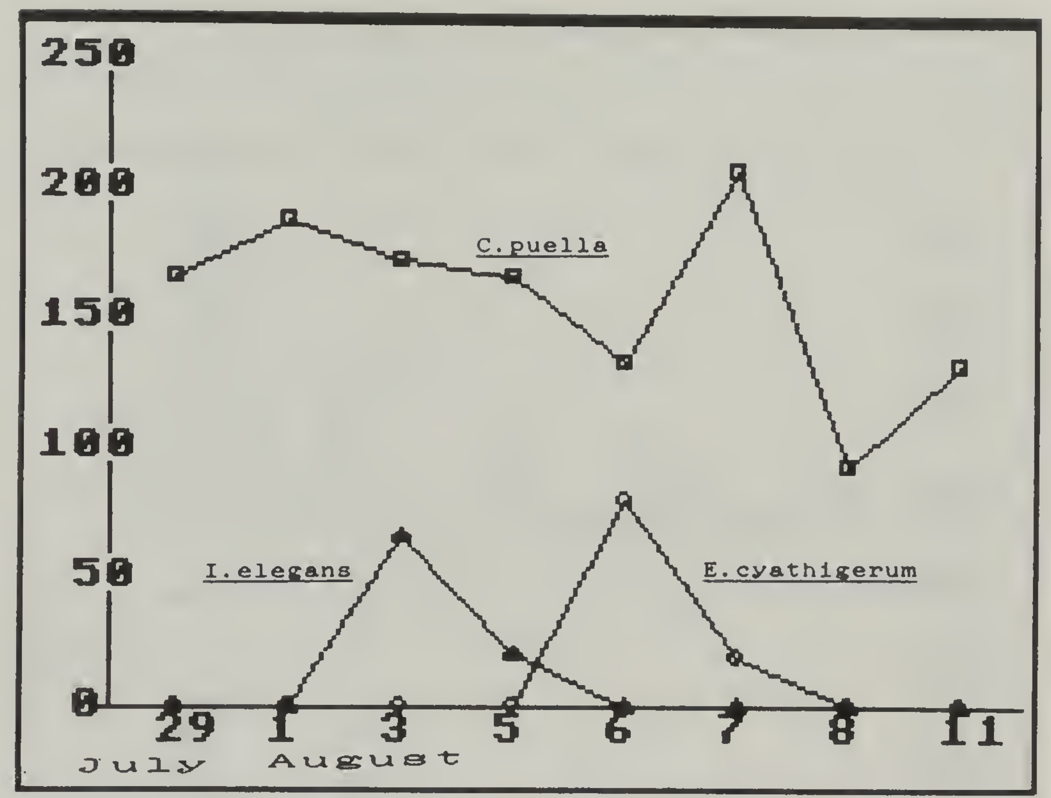


FIG. 2. 1985 population estimates using Jolly's stochastic method of male damselflies of three species at Lower Eastern Pond: *Coenagrion puella* the azure damselfly, *Ischnura elegans* the blue tipped damselfly and *Enallagma cyathigerum* the blue damselfly.

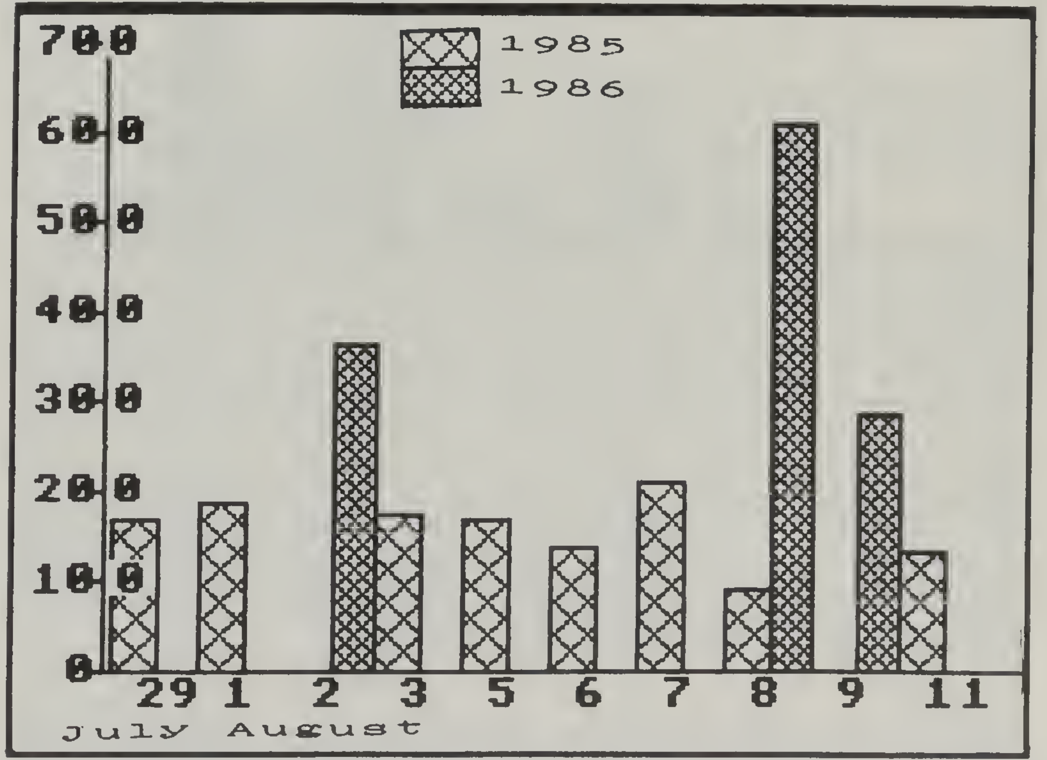


FIG. 3. Comparative population estimates using Jolly's stochastic method of male *Coenagrion puella* the azure damselfly at Lower Eastern Pond in 1985 and 1986.

cyathigerum were found altogether, and *I. elegans* appeared in fours and fives, but *L. sponsa* occurred on all survey days in numbers sufficient to calculate a population estimate of 352 for the first week of August. The 1986 estimates for *C. puella* and *L. sponsa* at Lower Eastern Pond are graphed at Figure 4.

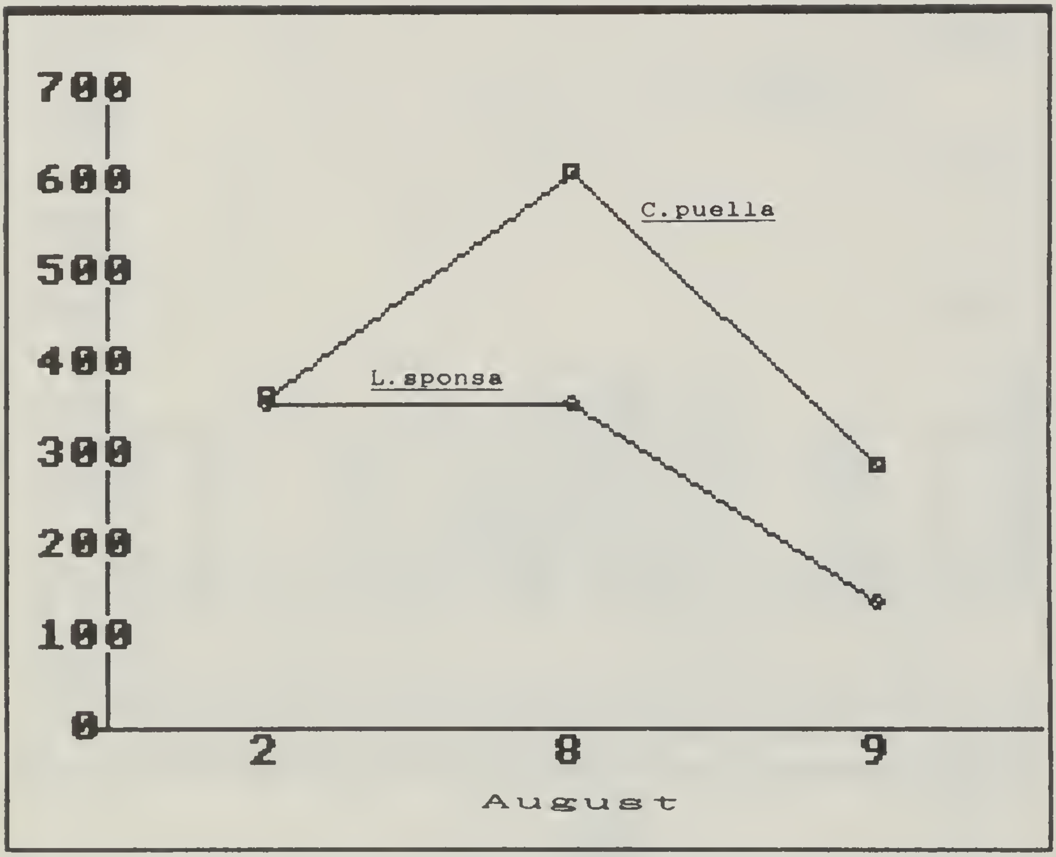


FIG. 4. 1986 population estimates using Jolly's stochastic method of male damselflies of two species at Lower Eastern Pond: *Coenagrion puella* the azure damselfly and *Lestes sponsa* the emerald damselfly.

The summer of 1985 was very bad for Odonata. According to the weather records from Wisley, from the beginning of June to the end of August, it rained on 58 days. The equivalent figure for 1986 was 36. Because there were so few damselflies about and because the survey was continued over 43 days, approximately half the marked insects were eventually recaptured, providing data on the known lifespan of 188 male *C. puella,* 17 male *I. elegans* and 17 male *E. cyathigerum.* The known lifespan of the *C. puella* populations from Lower Eastern Pond and South-East Pond are charted at Figure 5. Table 4 sets out the full story. Twenty per cent of the recaptured *C. puella* from Lower Eastern Pond are known to have survived for 15 days or more, as are 26% from South-East Pond. Figure 5 suggests that for both populations the first 13 or 14 days of known lifespan might form a symmetrical bell-shaped curve, but what is perhaps more surprising is what a large proportion of the population lived longer than this. Four of the 17 *E. cyathigerum* also lived longer than 15 days, but none of the 17 *I. elegans,* is known to have survived beyond 10 days.

2. Larvae

Dipping a net into Sheepbell Pond has not, in general, been a rewarding experience. There are animals in this pond, but they are neither abundant nor easily removed from the soft mud and decaying oak leaves. The artificial weed

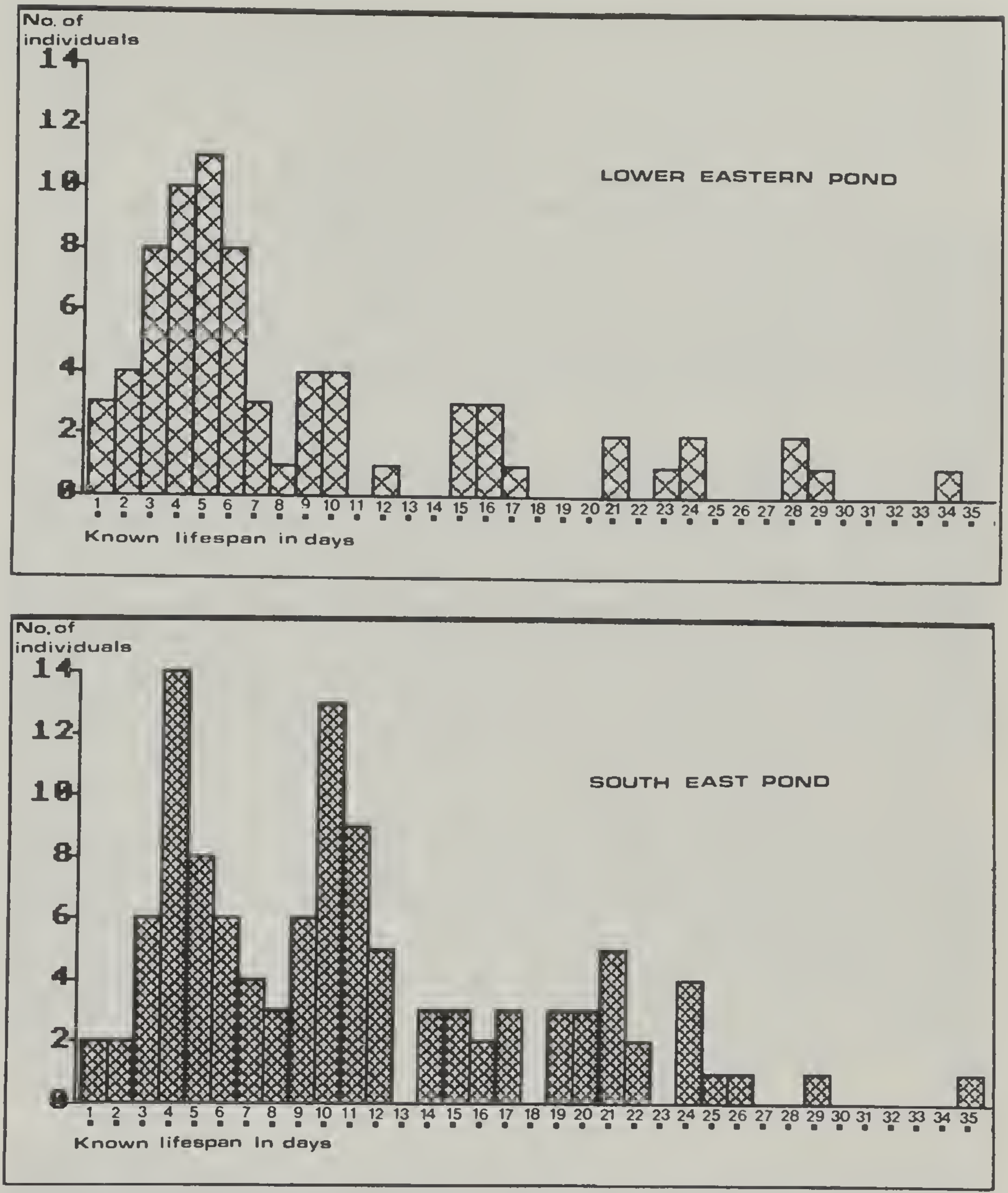


FIG. 5. Known lifespan of adult male *Coenagrion puella* the azure damselfly marked and recaptured at Lower Eastern Pond and South-East Pond in July and August 1985.

contained no animals at all. When it was removed through a hole in the ice on 26 January 1986, all it brought up was some decayed vegetation and a smell of hydrogen sulphide. Only two Odonata larvae have ever been found in five attempts to sample this pond and they were *Aeshna cyanea*, not *Pyrrhosoma nymphula*. The animals caught in this sample, taken on 1 September 1985, are listed at Table 5. South-East Pond, at which most of the larva sampling has been done, was netted for comparison on the same day. One important difference, apart from the fact that there are far more animals in South-East Pond, is that it frequently contains a large number of newt tadpoles. Smooth newts *Triturus vulgaris* were reported at South-East Pond by King (1979), so the larvae were assumed to belong to this species rather than the palmate newt. All three British newt species are known to occur on the Common (Stiles 1978).

The similarity index was calculated using the formula

$$S = \frac{2C}{A + B}$$

where A = the number of species in sample A
B = the number of species in sample B
and C = the number of species common to both samples.

It merely provides numerical confirmation that more species are found in South-East Pond.

Interestingly, the Shannon Index of diversity on this comparison of a very small sample appears higher for the stagnant Sheepbell Pond, supporting relatively few animals, than for South-East Pond, which is teeming with aquatic life. The reason for this is the relatively large numbers of members of a few species in South-East Pond.

Table 6, showing sampling at approximately monthly intervals presents the same pattern. The evenness indices are very low indeed. The artificial weed might be expected to show a smaller range of species as it would only attract animals which cling to vegetation or hide in crevices. Not surprisingly, therefore, 17 of the animals, 61% of the sample, are *C. puella*. Sampling South-East Pond has shown clearly that there is a large population of *C. puella* larvae in this pond and a fairly large population of *A. cyanea* larvae. The mix of species in this pond, however, may vary quite suddenly with different conditions. A sample taken on 12 December 1986 was not counted, but the common species (11-50 individuals) on that occasion were newt tadpoles *Triturus vulgaris*, hog lice *Asellus aquaticus* and freshwater shrimps *Gammarus pulex*. Only one *A. cyanea* larva was found and no *C. puella*.

Lower Eastern Pond was difficult to net in 1985 because the water level was unusually high following the very wet summer. The artificial weed placed there in March 1986 collected only seven *C. puella* larvae, 33 *G. pulex* and very small numbers (1-6) of other animals. After some vigorous and repeated netting among the reedmace *Typha latifolia*, on 19 November 1986, five *C. puella* larvae were found. Andy Merritt, found *Coenagrion* larvae in Isle of Wight Pond but none in Lower Eastern Pond, both of which he sampled on several occasions during the summer of 1986 (Personal communication). The reedmace is so dense that exuviae are not easy to find. One *A. cyanea* exuvium was found at Lower Eastern Pond, however, on 17 July 1985.

Discussion

Payne (1945) found *Coenagrion puella* the azure damselfly 'undoubtedly the most widespread and at its height the most plentiful dragonfly on the Common'. He quotes Lucas (1907) as finding it 'plentiful' in 1904 and 'the only species seen' on 31 May 1905. The 1985 results suggests that there is very little movement between ponds, the normal situation being a discrete population at each pond. Marking and recapture was not necessarily carried out when *C. puella* was at its peak, but rather when the greatest number of species might be expected to be present at the same time. Nevertheless two consecutive years' results show that though the absolute numbers of damselflies found fluctuates according to the weather, at Bookham, *C. puella* is at least twice as numerous as any other species.

This suggests that the habitat at Bookham Common must be especially suitable for it. Is it, however, the adult or the larval habitat that is critical? Welstead and Welstead (1984) say that in the New Forest the adults are found at 'slowly moving ditches and sheltered well vegetated ponds'. The larva lives 'among weeds in neutral or slightly alkaline water'. The ponds at Bookham are very sheltered, well vegetated and exceedingly weedy, so both conditions appear to be fulfilled. The male adult populations at Lower Eastern Pond and South-East Pond were roughly equal in size – slightly larger at South-East Pond, despite the fact that the larvae in South-East Pond must be an important food source for smooth newt and *Aeshna cyanea* larvae. Larval sampling, however, shows that despite this predation pressure, *C. puella* larvae are exceedingly abundant in South-East Pond.

Very few larvae were found at Lower Eastern Pond, despite the similar adult population. Netting of adults during the summer of 1985, however, shows that there is little movement between the two ponds, so it seems likely that the *C. puella* found at Lower Eastern Pond emerged from it. Possibly the important distinction is in the reeds. Lower Eastern Pond is surrounded on three sides by dense reedbeds of *Typha latifolia.* It is very difficult to get a net between the rigid densely packed stems, and it may well be that the larvae are there but not getting caught. The best place to find both *C. puella* and *A. cyanea* larvae at South-East Pond is the bed of branched bur reed *Sparganium erectum* on the south-east side of the pond. This is much easier to net than the *Typha* but the two habitats may well be equivalent from the larva's point of view.

Comparison of the two years' census of adult damselflies appears to show a dramatic increase in the numbers of *Lestes sponsa*, the emerald damselfly. Bratton and Langlois (1984) comment that *L. sponsa* is easily overlooked and may be under-recorded at Bookham. Only further work can clarify the position, but an alternative explanation might be that the numbers of this species show marked seasonal fluctuations. Payne (1945) records that it was seen on the common in 1930, 1934 and 1935, was absent during the first two years of his survey in 1942 and 1943 but that 'some dozen specimens' were seen in 1944. Payne attributes the fluctuations to dispersal despite the 'feeble powers of flight' of this species. He quotes Hammond's (1943) record of the visit of a male *L. sponsa* to a pond at Wood Green, to reach which it 'must have come several miles'.

While one individual could be carried a long distance by freak wind conditions, dispersal over a long distance does not seem a very likely explanation for a sixfold population increase between 1985 and 1986 from a number too small to give a population estimate to 350 males at Lower Eastern Pond. During the same time, the equivalent population of *Coenagrion puella*, the azure damselfly, had apparently trebled, rising from 200 to 600. Flight periods of *L. sponsa* observed at Bookham in 1982 and 1983 by Bratton and Langlois (1984) were from the end of July to the end of August, so the population survey was carried out at the right time of year.

It may be that *L. sponsa* is more severely hit by bad weather than *C. puella*. Merritt (1983) comments 'Cold wet summers have a detrimental effect on dragonfly populations, since prolonged inactivity inhibits both feeding and mating.' The summer of 1985 was very wet. If this had inhibited mating, however, one would expect fewer *L. sponsa* the following year, not more.

L. sponsa overwinters as an egg in diapause (Corbet 1956 in Pickup *et al.* 1984). In southern England the eggs hatch in mid-April and larval growth is completed in two to three months. No netting for larvae has yet been done in May and June, but possibly in cold wet years, a large number of eggs do not break diapause, but hatch only in the following year.

If the population increase is not a cyclical phenomenon, it may have been caused by a change in the habitat. Lower Eastern Pond attracts several species (eight in 1986) and it may be a marginal habitat for most of them. *Enallagma cyathigerum*, the blue damselfly, had a measurable though small population in 1985 but only three individuals were found in 1986. Welstead and Welstead (1984) say that the adult has a preference for areas of open water. It was certainly very abundant in 1986 at Richmond Park, where Penn Ponds fit this description admirably. The area of *Typha* is increasing each year at Lower Eastern Pond, and although the larva lives among weeds in neutral or slightly alkaline water (Welstead and Welstead 1984), adults may no longer find this pond attractive. Conversely it may have become more attractive to *Lestes sponsa,* the emerald damselfly. *L. sponsa,* however, also occurs at Penn Ponds, Richmond Park, though not in the same abundance as *E. cyathigerum.*

Payne (1945) too, found that *E. cyathigerum* came and went. It did not appear in 1942 and he assumed it had been excluded by encroaching vegetation and then several specimens of both sexes were observed in July 1943. He comments that 'The problem will repay further study.'

Payne (1945) found *Sympetrum striolatum,* the common darter, the most abundant anisopteran on the common, but Bratton and Langlois (1984) comment that in August 1982 *Sympetrum sanguineum,* the ruddy darter, appeared temporarily to have displaced *S. striolatum* from the ponds. Nationally *S. sanguineum* has an earlier flight period: the end of June to the beginning of September (Hammond 1977) compared to mid-June to the end of October for *S. striolatum.* Certainly I have not seen *S. striolatum* at Bookham, only both sexes of *S. sanguineum,* at both South-East and Lower Eastern Ponds. No detailed observations have been carried out after mid-August, but *S. striolatum* has been seen on 11 August and 15 September in 1984 and 26 August and 4 September in 1985 (D. A. Boyd, personal communication).

No larvae have been found. A. E. Gardner commented to Cynthia Longfield (1949*a*) that it was very difficult to catch the larvae by netting as they were usually right inside the root structure of *Typha latifolia.* At South-East Pond, they would have to make do with the *Sparganium,* but it would be quite easy for a small population to escape capture in the root structure.

These *Sympetrum* darter dragonflies, however, are very mobile. Moore (1964) marked 26 species of Odonata and compared recovery rates: No. recovered/No. not recovered. For the damselflies these varied from 1/1 to 1/4. Hardly any of the dragonflies (Anisoptera) were recovered. Moore's experiments also showed that most dragonflies disperse at the maiden flight. Longfield (1949*b*) describes 'Esher and the combined group of Surrey Commons round it' and 'Wisley Pond and those on the commons surrounding it' as 'localities of particular richness in dragonfly species'. Until either larvae or exuviae are found, the possibility that most of the adults seen have flown in from elsewhere cannot be discounted.

Judging from the work carried out so far, *Aeshna cyanea,* the southern hawker, may be the second most common species – or possibly the third after *Lestes sponsa.* Adults are frequently encountered in any sunny spot at Bookham, not just by the ponds. Three is the largest number so far seen together, but McGeeney (1986) comments that male *A. cyanea* patrol breeding sides on a timesharing basis, and this is born out by observations at Bookham. Schmidt (1985) writes 'There usually is good correspondence between abundance of adults during sexual or reproductive activities and abundance of larvae/frequency of emergence...' except at small or shaded habitats where adults are underrepresented such as '...*Aeshna cyanea* at dark woodland ponds.' There are certainly a large number of larvae in South-East Pond, two were found in Sheepbell Pond and one exuvium was found on 17 July 1985 at Lower Eastern Pond, which, considering the difficulty of finding exuviae in the *Typha* probably means that there were many more.

The population of *Pyrrhosoma nymphula,* the large red damselfly, at Sheepbell Pond is very small. This in itself is not surprising as the pond does not seem to be very productive. What is more surprising is that this species has not been found at any of the other ponds on the common. Payne (1945) found it most frequent on Bookham stream, which has not recently been surveyed. Corbet (1957) writes 'in Britain it has perhaps the widest ecological tolerance of any dragonfly: larvae develop successfully in swift moorland streams, fens or brackish clay marshes and productive gravel pits.' The larva tolerates a wide pH range, possibly preferring slightly acid conditions and is common on all types of aquatic habitat available in the New Forest (Welstead and Welstead 1984). It is a spring species which has a final instar diapause (Corbet 1957), emergence being determined by daylength and temperature. The larva lives among bottom debris and is usually found in dark places (Gardner and McNeill 1950). The usual larval period is two to three years (Corbet in Corbet *et al.* 1960).

There seems no reason from this why *Pyrrhosoma nymphula* should not have established a population at one of the other two ponds studied. They were less shaded than Sheepbell Pond and both had dense growths of pondweed, mostly rigid hornwort *Ceratophyllum demersum* with some broad leaved pondweed *Potamogeton natans.* They also had much larger populations of *Coenagrion puella,* which at Bookham has a very long flight period, the beginning of which probably coincides with that of *P. nymphula.* Both species emerged between 8 and 17 June in 1986.

Perhaps the wide ecological tolerance of *P. nymphula* is its main competitive advantage. Macan (1963) found it co-existing in Hodsons Tarn with *Enalagma cyathigerum* where it occupied the thick *Carex* beds at the edge, leaving the *Myriophyllum* beds in the middle of the tarn to *E. cyathigerum. E. cyathigerum,* however, is known to prefer more open water. Perhaps the habitat requirements of adult *Coenagrion puella* are closer to those of *Pyrrhosoma nymphula* and competition in the adult stage prevents *P. nymphula* from becoming more numerous at Bookham. *C. puella* is more abundant even in the less favourable conditions of Sheepbell Pond. This might explain why Payne (1945) found the largest group of *P. nymphula* at a running water site, where presumably there was no competition from *C. puella.*

McGeeney (1986: 8) writes 'Most damselflies have an average life of one or two weeks, with a maximum of eight weeks.' *Coenagrion puella* at Bookham seems to fit within this range if teneral lifespan is excluded. Corbet (Corbet *et al.* 1960: 101) writes that in *Anax, Pyrrhosoma* and *Lestes* the maturation period lasted for about two weeks. About a quarter of the marked *C. puella* had a mature lifespan of more than two weeks in 1985. The numbers of *Enallagma cyathigerum* and *Ischnura elegans,* the blue-tipped damselfly, marked were very much smaller, but none of the *I. elegans* was found after 10 days of adult life, whereas *E. cyathigerum* appears to have a lifespan similar to *C. puella.* Moore (1964) marked 153 male *I. elegans* of which he recovered 32. The longest time he recorded between marking and last recovery was 19 days. This suggests that the smaller *I. elegans* may have a shorter lifespan than *C. puella.*

Not enough work has yet been done on the aquatic part of the life-cycle to make very many comments on larval abundance in relation to habitat or food availability, but competition with amphibians must be a factor in South-East Pond. Newt larvae were found as late as October in 1985 and December in 1986. The annual input of oak leaves probably also changes the balance of species in the pond. It was no doubt their presence as much as the die-back of the bur reed which caused the detritivore *Asellus aquaticus* to become so abundant during the mild weather at the beginning of December 1986.

Tables 1-6 follow:

TABLE 1. Male Odonata captured or observed at Bookham Common ponds[1]

1985	July						August									
	9	12	14	17	18	29	1	3	5	6	7	8	11	12	17	21
Sheepbell Pond[2]																
Coenagrion puella	—	13	35	5	3	0	18	—	—	—	—	8	—	—	—	—
Pyrrhosoma nymphula	—	4	2	0	0	0	0	—	—	—	—	0	—	—	—	—
Aeshna cyanea	—	0	0	0	0	1	2	—	—	—	—	1	—	—	—	—
Lower Eastern Pond																
Coenagrion puella[3]	35	22	39	—	40	40	40	40	27	13	23	3	14	17	1	3
Enallagma cyathigerum	4	6	0	—	5	10	8	16	15	3	3	0	10	2	1	1
Ischnura elegans	0	0	0	—	1	5	2	21	8	3	5	0	5	11	2	3
Lestes sponsa	0	0	0	—	0	4	0	0	3	0	1	0	6	0	4	1
Aeshna cyanea	0	0	0	—	2	0	0	3	0	0	0	8	0	3	1	2
Sympetrum sanguineum	0	0	0	—	0	0	0	0	0	0	0	0	2	4	1	5
South-East Pond																
Coenagrion puella[3]	58	36	22	—	40	40	12	—	14	40	25	55	7	29	40	40
Ischnura elegans	0	2	0	—	0	4	0	—	0	0	0	0	0	0	0	0
Lestes sponsa	0	0	2	—	0	0	1	—	4	1	3	2	0	2	4	0
Aeshna cyanea	0	0	0	—	0	1	1	—	0	0	0	2	3	0	0	1
Sympetrum sanguineum	0	0	0	—	0	0	0	—	0	1	0	3	2	1	1	1

1986	June				August				
	8	17	19	25	1	2	8	9	10
Sheepbell Pond									
Coenagrion puella[4]	0	7	0	2	—	—	—	—	—
Pyrrhosoma nymphula	0	8	0	3	—	—	—	—	—
Lower Eastern Pond									
Coenagrion puella	0	35	—	—	35	42	30	64	45
Enallagma cyathigerum	0	0	—	—	2	1	0	0	0
Ischnura elegans	0	1	—	—	4	5	0	4	5
Lestes sponsa	0	0	—	—	15	36	31	15	26
Aeshna cyanea	0	0	—	—	2	2	1	1	1
Aeshna grandis	0	0	—	—	1	0	0	0	0
Sympetrum sanguineum	0	0	—	—	1	0	1	1	1
Libellula depressa	0	0	—	—	1	0	0	0	0

(1) The damselfly (Zygoptera) numbers are those actually netted and marked. Dragonflies (Anisoptera) were usually not netted if species and sex could be clearly distinguished by observation.

(2) A dash (—) in the table means that the site was not visited on that day. Sheepbell Pond is so heavily shaded that there was little point in going there in overcast conditions.

(3) On days when *C. puella* was abundant, the author often netted 40 and then moved on to the next pond. The number of males actually present could have been as high as 70.

(4) These are the numbers of male *C. puella* actually netted, but as the main effort on these days was to establish the size of the *P. nymphula* population, they almost certainly under-represent the numbers present. There were more *C. puella* present at Sheepbell Pond than *P. nymphula*.

TABLE 2. Female Odonata captured or observed at Bookham Common ponds[1]

1985	July						August									
	9	12	14	17	18	29	1	3	5	6	7	8	11	12	17	21
Sheepbell Pond																
Coenagrion puella[2]	—	2	5	0	0	0	0	—	—	—	—	0	—	—	—	—
Pyrrhosoma nymphula	—	0	0	0	0	0	0	—	—	—	—	0	—	—	—	—
Aeshna cyanea	—	0	0	0	0	0	0	—	—	—	—	0	—	—	—	—
Lower Eastern Pond																
Coenagrion puella[2]	0	0	1	—	0	0	0	0	0	0	0	0	0	0	0	0
Enallagma cyathigerum	0	0	0	—	0	0	0	0	1	0	1	0	0	1	3	0
Ischnura elegans	0	0	0	—	0	0	1	2	0	0	0	0	1	1	1	0
Lestes sponsa	0	0	0	—	0	1	1	4	1	1	1	0	5	0	1	0
Aeshna cyanea	0	0	0	—	0	0	0	0	0	0	0	0	0	3	1	0
Sympetrum sanguineum	0	0	0	—	0	0	0	0	0	0	0	0	1	0	1	0
South-East Pond																
Coenagrion puella[2]	4	1	0	—	0	0	0	—	1	9	0	0	0	1	2	0
Ischnura elegans	0	0	0	—	0	0	0	—	0	0	0	0	0	0	0	0
Lestes sponsa	0	0	1	—	0	0	1	—	0	0	1	0	0	0	1	0
Aeshna cyanea	0	0	0	—	0	0	0	—	0	1	0	0	0	0	1	0
Sympetrum sanguineum	0	0	0	—	0	0	0	—	0	1	0	1	0	1	0	0

1986	June				August				
	8	17	19	25	1	2	8	9	10
Sheepbell Pond									
Coenagrion puella[2]	0	0	1	0	—	—	—	—	—
Pyrrhosoma nymphula	0	4	1	0	—	—	—	—	—
Lower Eastern Pond									
Coenagrion puella[2]	0	0	—	—	0	0	1	8	1
Enallagma cyathigerum	0	0	—	—	0	0	0	0	0
Ischnura elegans	0	0	—	—	0	0	0	0	0
Lestes sponsa	0	0	—	—	4	4	1	5	3
Aeshna cyanea	0	0	—	—	0	0	0	0	0
Aeshna grandis	0	0	—	—	0	1	1	1	1
Sympetrum sanguineum	0	0	—	—	0	0	0	0	1
Libellula depressa	0	0	—	—	0	0	0	0	0

(1) The same conventions have been observed as in Table 1. The damselfly (Zygoptera) numbers are those actually netted and marked. Dragonflies (Anisoptera) were usually not netted if species and sex could be clearly distinguished by observation.

(2) Female *C. puella* were almost invariably found only in tandem. Very few were present, but it is possible that the author unconsciously selected unattached males instead where there was a choice.

TABLE 3. Populations of male damselflies estimated by Jolly's Stochastic Method at Bookham Common ponds.

1985	July	August								
	29	1	3	5	6	7	8	11	12	17
Lower Eastern Pond										
Coenagrion puella	165	187	172	165	133	206	92	131	—	—
Enallagma cyathigerum	—	—	—	—	80	18	—	—	—	—
Ischnura elegans	—	—	66	20	—	—	—	—	—	—
South-East Pond										
Coenagrion puella	—	—	—	117	210	235	230	178	101	236

1986	August		
	2	8	9
Lower Eastern Pond			
Coenagrion puella	363	609	284
Lestes sponsa	352	352	133

TABLE 4. Known lifespan of male damselflies marked and recaptured at Bookham Common ponds over a 43-day period in 1985.

Number of individuals which were marked and recaptured and are therefore known to have lived for this period

	South-East Pond	**Lower Eastern Pond**		
Known lifespan in days	*Coenagrion puella*	*Coenagrion puella*	*Ischnura elegans*	*Enallagma cyathigerum*
1	2	3	—	—
2	2	4	1	1
3	6	8	5	5
4	14	10	—	1
5	8	11	3	1
6	6	8	4	2
7	4	3	1	—
8	3	1	1	2
9	6	4	—	—
10	13	4	2	1
11	9	—		—
12	5	1		—
13	—	—		—
14	3	—		—
15	3	3		—
16	2	3		—
17	3	1		—
18	—	—		—
19	3	—		1
20	3	—		—
21	5	2		—
22	2	—		—
23	—	1		—
24	4	2		—
25	1	—		—
26	—	—		—
27	—	—		1
28	—	2		2
29	1	1		
. .	. .	. .	. .	. .
34	—	1		
35	1	—		
Total	110	78	17	17
No. of these surviving 15+ days	29	16	0	4
Total no. captured but not recaptured	219	140	31	46

TABLE 5. Freshwater animals caught with four random dips of the net on 1st September 1985 at each of two ponds.

Sheepbell Pond	No.	**South-East Pond**	No.
ANNELIDA			
		Paranais sp.	1
ARTHROPODA			
Crustacea			
Gammarus pulex	3	*Gammarus pulex*	7
Cyclops sp.	2	*Cyclops* sp.	5
Insecta			
Aeshna cyanea	2	*Aeshna cyanea*	5
		Coenagrion puella	11
Corixa sp.	1	*Corixa* sp.	12
Dytiscus sp.	1	*Dytiscus* sp.	1
		Chironomid sp.	1
MOLLUSCA			
Planorbis complanatus	1		
VERTEBRATA			
		Triturus vulgaris	11
Shannon Index of Diversity	2.07		1.70

Similarity Index comparing the two ponds 0.26

TABLE 6. Freshwater animals caught on successive sampling occasions at South-East Pond, using two different methods.

	Netting 28 Sept. '85	Netting 20 Oct. '85	Netting 10 Nov. '85	Art. weed 26 Jan. '86	Netting 9 Mar. '86
TURBELLARIA					
Dugesia tigrina	0	12	0	0	11
HIRUDINEA					
Theromyzon tessulata	5	0	0	0	0
CRUSTACEA					
Gammarus pulex	63	39	5	0	43
Asellus aquaticus	5	0	7	2	15
Cyclops sp.	0	1	0	1	0
Daphnia sp.	1	0	0	0	0
INSECTA					
Aeshna cyanea	1	5	3	0	1
Coenagrion puella	10	23	34	17	6
Corixa sp.	2	2	2	0	0
Hygrobia hermani	1	0	0	0	0
Dytiscus marginalis	0	0	1	0	0
Dytiscus sp.	1	0	0	0	0
Diptera sp.	1	0	0	0	0
Chaoborus sp.	1	0	0	0	0
Chironomid sp.	0	3	38	8	1
Trichoptera sp.	0	0	1	0	1
MOLLUSCA					
Limnaea stagnalis	5	8	6	0	2
Sphaerium lacustre	1	0	4	0	3
VERTEBRATA					
Triturus vulgaris	3	0	0	0	0
Shannon Index of Diversity	1.43	1.71	1.74	0.97	1.48
Evenness Index	0.56	0.78	0.72	0.70	0.67

References

ARTHURE, B. F. 1979. Survey of Bookham Common: Thirty-seventh year: Aquatic invertebrates. *Lond. Nat.* **58:** 40-41.

BEGON, M. 1979. *Investigating Animal Abundance. Capture-recapture for biologists.* Arnold, London.

BEHRENDT, A. 1977. *The Management of Angling Waters.* Deutsch, London.

BEVEN, G. 1978. Survey of Bookham Common: Thirty-sixth year: General. *Lond. Nat.* **57:** 61.

BLOWER, J. G., COOK, L. M. and BISHOP, J. A. 1981. *Estimating the Size of Animal Populations.* Allen and Unwin, London.

BRATTON, J. H. and LANGLOIS, D. 1984. Notes on the dragonflies of Bookham Common. *Lond. Nat.* **63:** 133-136.

CORBET, P. S., LONGFIELD, C. and MOORE, N. W. 1960. *Dragonflies.* Collins New Naturalist, London. Limpback Ed. 1985.

GARDNER, A. E., and MacNEILL, N. 1950. The life history of *Pyrrhosoma nymphula* (Sulzer) (Odonata). *Entomologist's Gaz.* **1:** 163-182.

GARDNER, A. E. 1955. *A key to larvae* in HAMMOND, C. O. 1977

HAMMOND, C. O. 1943. *Entomologist* **76:** 150.

HAMMOND, C. O. 1977. Revised MERRITT, R. 1983. *The Dragonflies of Great Britain and Ireland.* Ed. 2. Harley Books, Colchester.

HINNEKINT, B. O. N. 1974. An individual marking technique for Odonata. *Odonatologica* **3** (4): 261-263.

KING, P. W. 1979. Amphibia and Reptilia in the London Area 1978. *Lond. Nat.* **58:** 69-70.

LONGFIELD, C. 1949*a*. The Dragonflies of the London Area. *Lond. Nat.* **28:** 80-98.

LONGFIELD, C. 1949*b*. *The Dragonflies of the British Isles.* Ed. 2. Warne, London.

LUCAS, W. J. 1907. *Entomologist* **40:** 30.

MACAN, T. T. 1959. *A Guide to Freshwater Invertebrate Animals.* Longman, London.

MACAN, T. T. 1964. The Odonata of a moorland fishpond. *Int. Rev. Hydrobiol.* **49:** 325-360.

MACAN, T. T. 1974. *Freshwater Ecology.* Ed. 2. Longman, London.

McGEENEY, A. 1986. *A Complete Guide to British Dragonflies.* Cape, London.

MERRITT, R. 1983. in HAMMOND, C. O. 1977.

MOORE, N. W. 1964. Intra- and interspecific competition among dragonflies (Odonata). *J. Anim. Ecol.* **33:** 49-71.

PARR, M. J. 1965. A population study of a colony of imaginal *Ischnura elegans* at Dale, Pembrokeshire. *Fld Stud.* **2:** 237-282.

PARR, M. J. and PALMER, M. 1971. The sex ratios, mating frequencies and mating expectancies of three coenagriids in northern England. (Odonata: Zygoptera) *Ent. scand.* **2:** 191-204.

PARR, M. J. 1973. Ecological studies of *Ischnura elegans* (van den Linden) (Zygoptera: Odonata). I Age Groups, Emergence Patterns and Numbers. *Odonatologica* **2** (3): 139-157. II Survivorship. Local Movements and Dispersal. *Odonatologica* **2** (3): 159-174.

PARR, M. J. 1976. Some aspects of the population ecology of the damselfly *Enallagma cyathigerum* (Charpentier), *Odonatologica* **5** (1): 45-57.

PAYNE, R. M. 1945. Notes on the distribution of dragonflies on Bookham Common. *Lond. Nat.* **24:** 23-31.

PICKUP, J., THOMPSON, D. J. and LAWTON, J. H. 1984. The life history of *Lestes sponsa* (Hansemann): Larval Growth (Zygoptera: Lestidae). *Odonatologica* **13:** 451-461.

RADCLIFFE, B. R. 1978. Survey of Bookham Common: Thirty-sixth year: Upper and Lower Eastern Ponds. *Lond. Nat.* **57:** 63.

SCHMIDT, E. 1985. Habitat Inventorization, Characterization and Bioindication by a 'Representative Spectrum of Odonata Species (RSO)'. *Odonatologica* **14** (2): 127-133.

SPREADBURY, W. H. 1956. Bookham Common before 1914 and after. *Lond. Nat.* **36:** 54-57.

WELSTEAD, N. and WELSTEAD, T. 1984. *The Dragonflies of the New Forest.* Hampshire and Isle of Wight Naturalists' Trust.

Botanical Records for 1986

by R. M. BURTON*

Summary

This paper presents a selection of interesting flowering plant and fern discoveries in the London area in 1986. The most remarkable are *Limosella aquatica* in Bushy Park, *Myosurus minimus* near North Mimms and a large population of *Oenanthe fluviatilis* in the New River.

Introduction

In this paper the most interesting records of flowering plants made in 1986 within 32km of St Paul's Cathedral are divided among the Vice-Counties as described by Watson (1852). Within each vice-county records from London boroughs are presented before those from outlying parts of the circle.

During 1986 the Greater London Ecology Unit surveyed a number of sites which will be featured in a handbook on neutral grasslands in London, to be published probably before this paper. Although their object was to produce an account of the best sites, which can generally be expected to be comparatively little disturbed relics of ancient pasture or hay-meadow, rather than to find new localities for uncommon plant species, nevertheless they succeeded in doing the latter, as will be reported here. In particular they found several new sites for the brown sedge *Carex disticha*.

V.C. 16, West Kent

The most important of the few records received from the Greater London portion of our area lying in the Watsonian vice-county of Kent is certainly the one supported by the specimens sent to me by D. J. Kite, the Nature Conservancy Council's Assistant Regional Officer for Greater London. These vouch for the presence in three places on Crayford Marshes, an area threatened by development proposals, of the sedge *Carex disticha* already mentioned. The surprising aspect of this discovery is that the plant had previously been overlooked, having been taken for the even less common species *C. divisa* which also occurs in that region, more strictly limited to damp hollows near the tidal rivers. Nearer London on the Thames bank in Kent, J. R. Palmer found the London rocket *Sisymbrium irio* above Erith in the stretch where many unusual plants have been found by him over several years associated with the oil-milling works there. A couple of the many interesting hybrids reported by G. D. Kitchener in 1986 are in Greater London. The white mullein *Verbascum lychnitis* has long been known from Elmstead Woods Station; its hybrid with the common mullein is called *V.* × *thapsi*, and a number of plants of it were there in an area which has been burned off, keeping the habitat open. The hybrid of the sweet and hairy violets, *Viola* × *permixta*, was on a chalky bank in Cuckoo Wood, Downe with the two parent species.

In Halstead, just outside the present boundary of London, Mr Kitchener found two hybrid willow-herbs quite close to each other, *Epilobium adenocaulon* × *montanum* and *E. adenocaulon* × *tetragonum*. Both were distinctive on account of their unusually extended flowering branches and season, and not difficult to identify in the field. A far more remarkable hybrid is × *Dactlogymnadenia cookei*, the cross between fragrant and spotted orchids, near Shoreham where it was previously seen in 1932 and 1934 by R. W. Robbins. Of the many other records supplied by Mr Kitchener, I will select for mention dense-flowered

---

*Sparepenny Cottage, Sparepenny Lane, Eynsford, Kent DA4 0JJ.

fumitory *Fumaria micrantha* from a chalky field at Kemsing and Chinese lanterns *Physalis alkekengi* near Twitton, a large colony spreading from a railway bank into the adjacent arable field. He and I both noticed the very large numbers of narrow-leaved pepperwort *Lepidium ruderale* forming a band parallel to the band of *Puccinellia distans* lining the main road south of Eynsford. My own best plants were also close to the address at the foot of page 185, the garden of which had a knotgrass I had not noticed before, *Polygonum rurivagum*, among its weeds. A remade length of verge along the lane had several plants of bristly hawksbeard *Crepis setosa* and only a little further away in stubble I found a good colony of gromwell *Lithospermum arvense*. Nearer Shoreham I chanced upon the one small population in Kent of the grass *Bromus benekenii* where it was found by R. C. Palmer in 1973.

V.C. 17, Surrey

In the metropolitan part of Surrey the most numerous records received are those of J. E. Harvey. Many of his plants are seedlings of planted trees, not likely to survive long in insufficient soil, but of possibly more permanent interest is his hemp agrimony *Eupatorium cannabinum* from railway sites near Herne Hill and Streatham. The former site also produced a colony of pale toadflax *Linaria repens*, a strong plant of sulphur cinquefoil *Potentilla recta* and other items of interest. Also in Streatham, Mrs E. Norman saw alexanders *Smyrnium olusatrum* on a patch of waste ground. A third-floor window box two minutes walk from Tower Bridge (not, presumably, including the time spent going up stairs) is the unexpected habitat of *Campanula trachelium* reported by Keith Fletcher; I suggest that the seed for this came from across the river where the plant has long been established in the gardens in the Tower moat. Rupert Hastings again sent me a usefully detailed list of plants seen in Kew Gardens and elsewhere; I do not think I have previously mentioned the moth mullein *Verbascum blattaria* which puts in a very occasional appearance around Kew, and in 1986 was represented by one plant in the yard by Cambridge Cottage. Graham Medcalf sent me a note of garden escapes he found at Shirley, of which the best naturalised, or at least furthest from houses, was the autumn-flowering *Crocus nudiflorus*. At the other end of the year, A. C. Leslie gave me details of sites of *C. tommasinianus* and *Galanthus elwesii* and its hybrid with the common snowdrop *G. nivalis* well naturalised near the River Wandle in the Morden area.

Outside the London boundary, Dr Leslie found a convincing hybrid mullein *Verbascum lychnitis* × *nigrum* = *V.* × *schiedeanum* with its parents on the side of Nore Hill. He was among the many who saw the rare plants of Fames Rough, the famous field at Chipstead where cut-leaved germander *Teucrium botrys* came up in good quantity in 1986 as the intended result of ploughing in the previous winter, but not all of the others will have noticed on ant-hills the rare grass *Nardurus maritimus* which has been searched for in vain many times since it was seen there in the 1960s. Our meeting of 6 July to the Box Hill area failed to find wild candytuft *Iberis amara* where it used to be known on White Hill, but in compensation came across one plant of lesser centaury *Centaurium pulchellum* on Juniper Hill, which seems to be a new locality for this uncommon plant. Near Leatherhead Brian Wurzell found a chalky field with spectacular bushes of wild catmint *Nepeta cataria* which has become extremely rare in Surrey, also over 100 Venus's looking-glass *Legousia hybrida* and 50 smooth-fruited corn-salad *Valerianella dentata*, both of them uncommon and rapidly decreasing cornfield weeds in the county.

V.C. 18, South Essex

The area now called Eastbrookend, though it used to be known as Dagenham Chase, already surveyed in 1984 by the team from the Passmore Edwards Museum (Plant *et al.* 1985), was re-surveyed in 1986 by T. Pyner, whose list of additional plant species reached me through the good offices of Roger Payne of the Southend Museum and Colin Plant of the P.E.M. Mr Pyner's best discovery was the round-fruited rush *Juncus compressus,* seen in this area by Mrs P. S. Swettenham in 1978, though that record was never published, but otherwise not known from the part of Essex near London since the last century. The lesser sea-spurrey *Spergularia marina* and a water-crowfoot *Ranunculus baudotii* are two species in his list normally associated with brackish conditions, of which there is no other evidence, the water fern *Azolla filiculoides* being a freshwater plant. Another species associated with submaritime conditions in its natural state is dittander *Lepidium latifolium,* which was shown to our meeting of 14 June by Barry Watson near the tideway on Ripple Level where he had discovered it the year before. Not far away I found (and lost again before I could show it to anybody) a single plant of the alien cinquefoil *Potentilla intermedia,* and we came across three patches of the sedge *Carex divisa* already mentioned under Kent, probably where it was previously seen by Lousley in 1954. In 1986 Mrs Swettenham found dyer's greenweed *Genista tinctoria* and that curious leguminous alien *Scorpiurus muricatus* on waste ground near Upminster; the former might be a relic of old meadow grassland in this area, the latter is perhaps from bird-seed scattered on allotments. I am indebted for these records to K. J. Adams, who himself found least toadflax *Chaenorrhinum minus* at South Woodford Central Line station; this is still a frequent weed of railways west of London, but is virtually unknown on the Essex side.

Outside the Greater London boundary in Epping Forest Dr Adams conducted a census of the known plants of wild golden-rod *Solidago virgaurea,* not a difficult matter as there are only four, two in one known locality, none in the other where it has not been seen for several years, and two in a new locality. It is significant that the surviving plants are all on roadsides; most of the Forest is either too dark or too wet to support this species, which is not nearly so rare, though still uncommon, in suitable districts in Kent. Even nearer the boundary in the neighbourhood of Hainault Forest, Dr Adams was able to supply good detail of the colonies of small gorse *Ulex minor* mentioned in *The Flora of Essex* (Jermyn 1974) as having been found there by his wife in 1972.

V.C. 19, North Essex

Also found by Mrs J. M. Adams were the first plants of corn crowfoot *Ranunculus arvensis* in that part of v.c. 19 which lies within 20 miles of St Paul's Cathedral; there were three of them on a new cart track, formerly an arable field, near Roydon. Another track nearby had a bank with very large numbers of grass vetchling *Lathyrus nissolia* and 18 plants of *Crepis setosa.* The latter was first found here in 1984 by Dr Adams, who also found *Carex strigosa* then in a deep stream gully nearby. Both these species are new to our records from this vice-county.

V.C. 20, Herts

Only a small part of Hertfordshire as it was in Watson's day is now in Greater London, but it includes Saffron Green where the Greater London Ecology Unit found a small stand of *Carex disticha* from which I have seen a voucher specimen; it has not been noted previously in this area. It also includes Totteridge, where Dr D. Griffith found mullein *Verbascum thapsus,* not mentioned in her paper (Griffith 1986), at the old chapel site.

The outer part of the vice-county in the London area had two remarkable field weeds found in it in 1986. Miss J. Colthup told me of the spreading bur-parsley *Torilis arvensis* found by a group of people of which she was one in a field near the M25 motorway west of Rickmansworth, and G. P. Smith made the splendid discovery of mouse-tail *Myosurus minimus* in a field south of North Mimms. Mr Smith was also among those who took part in surveys of Hertford Heath, where petty whin *Genista anglica* was among the plants found, and the New River between Cheshunt and Stoke Newington in Middlesex. This waterway had previously been inaccessible to botanists, but the survey made the very unexpected discovery that long stretches of the river, an old artificial watercourse as its name may be thought to suggest, have large quantities of river water-dropwort *Oenanthe fluviatilis,* first noticed in this survey by Mr Wurzell. This plant was raised to the status of species by Coleman, the author of the first Hertfordshire flora. It is known from a few places in Ireland and in three or four continental countries, but most colonies of it are in rivers of lowland England, where in recent years it has almost certainly decreased very rapidly due to decline in water quality and perhaps in some places also to extraction of water by water authorities. A detailed survey of the abundance of *O. fluviatilis* in different stretches of the New River was conducted by Dr Steve Smith of the Polytechnic of Central London and I am grateful to Madeline Holloway of the London Wildlife Trust for copying his findings to me.

Mrs A. M. Boucher's records include 11 plants of violet helleborine *Epipactis purpurata* in Thunderfield Grove, Cheshunt, first found in 1985 by Mr and Mrs A. Woods but not immediately recognised, and the hybrid of sticky groundsel and Oxford ragwort which we have got used to calling *Senecio* × *londinensis* though an older name *S.* × *subnebrodensis* has recently come to light, with the parent species in the grounds of Hertford County Hospital. P. J. Ellison told me about the alien burdock *Arctium tomentosum* which he had found on the canal towpath at Rickmansworth in 1982, the only previous records of which in the London area were also near canals, at Yiewsley in 1916 and 1919 and at Dobbs Weir in 1964.

V.C. 21, Middlesex

The survey of the New River already mentioned found *Oenanthe fluviatilis* southward as far as Hornsey, though the plant was more plentiful further north beyond the tunnel under Wood Green. Other plants of the New River reported to me include narrow-leaved water-parsnip *Berula erecta*, water-starworts *Callitriche hamulata* and *C. intermedia* and unbranched bur-reed *Sparganium emersum.* Unusual plants found on adjacent ground which had been made accessible as a result of the survey included the rare variety of bellbine with lobed flowers *Calystegia sepium* var. *quinquepartita,* a hybrid willow-herb *Epilobium adenocaulon* × *hirsutum*, mother of thousands *Helxine soleirolli* on a weir at Hornsey and a variety of plants of rural character hidden from general view in Finsbury Park. For notes of all these I have to thank D. Bevan, G. P. Smith, B. Nicholson and B. Wurzell.

Most of the neutral grassland sites visited by the survey mentioned in the introduction were in v.c. 21. *Carex disticha* was found in the survey at Frays Meadows near Uxbridge, Islips Manor fields west of Northolt and elsewhere. Rarer plants at the latter site included sawwort *Serratula tinctoria* which has not been reported in this area previously and is becoming very rare elsewhere in Middlesex, though it might still occur on Hounslow Heath. At Little Britain near West Drayton in the Colne Valley they found marsh arrow-grass *Triglochin palustris,* another declining species, in two wet fields, and their discovery of great burnet *Sanguisorba officinalis* near Boot Pond, Bentley Priory, fills a gap in the known distribution of this indicator of ancient grassland in north Middlesex. Dr A. D. R. Hare of this survey team also told me of a plant of *Smyrnium olusatrum* which he saw below a street-lamp in the middle of Hackney.

More astonishing than any of the other plants mentioned so far was the mudwort *Limosella aquatica* found by Heron Pond in Bushy Park by Mrs L. J. Hyde and her daughter Miss P. A. Hyde. When Mrs Hyde first sent me a piece of this plant for naming, not unwillingly as there was plenty of it there, I was not immediately able to believe that it could be this plant which was last seen in Middlesex in 1875 and has not previously been found in Bushy Park ever, even by

Mrs Hyde who lives near and goes there quite often. This specimen finished up at the British Museum (Natural History) where comparison with the many others there showed that it is larger in all its parts than all other British specimens and is more like material from Eastern Canada. In the rutting season a few weeks after it was found in Bushy Park, the plant was very much disturbed by deer, which may well help to ensure its survival, so that as many people will be able to go and see it in 1987 as did in 1986.

The remaining noteworthy Middlesex records, like the foregoing all from that part of the vice-county now in Greater London, can be squeezed into one paragraph. John Latham found whitlow-grass *Erophila verna* on a gravel path in Bishop's Park, Fulham and at the other end of the year in the same area a *Polygonum* which D. H. Kent and I both think is most probably the hybrid of persicaria and water-pepper, *P.* × *intercedens*, though the material available for determination, by no fault of Mr Latham, is scarcely good enough for certain identification. This hybrid has not been reported from the London area before. Continuing on the subject of hybrids, Mr Kitchener found the hybrid of the great hairy and American willow-herb *Epilobium* × *novae-civitatis* by the canal at Marylebone and Mr Wurzell pointed out a plant of *Senecio* × *subnebrodensis* at the Finsbury Park end of the Parkland Walk. This was reported to me by Mr Bevan who in the course of a comparative study of Coppetts and Coldfall Woods found pill sedge *Carex pilulifera* and wood cow-wheat *Melampyrum pratense* in the latter. Near Coppetts Wood, which after a considerable battle is to be retained as a nature reserve, Mr Wurzell found for Mr Bevan a plant of *Poa palustris*, a rare grass which is here presumably an alien. An undoubted alien is the spurge *Euphorbia corallioides* which Mr Bevan found in Highgate Cemetery, probably the result of 'wild flower seed' having been scattered there a few years ago. Mr Bevan found soft shield-fern *Polystichum setiferum* both in the cemetery, where it would be a survivor from Victorian plantings, and in Mad Bess Wood by a ditch, where it appeared quite wild. The edge of Brent Reservoir was the unlikely location of a single plant of large cuckoo-pint *Arum italicum* observed by W. G. Teagle. Leslie Williams found prickly sedge *Carex muricata* in Old St Andrews churchyard not far from the reservoir dam. Tom Gittings, a visiting student, collected a specimen of yellow vetchling *Lathyrus aphaca* on a railway embankment next to Gifford Street, N1. Barry Nicholson sent for check a specimen of narrow-leaved water-dropwort *Oenanthe silaifolia* from near Ten Acres Wood, well to the north of the recently discovered large population of this rare meadow umbellifer at Yeading. David Elliston Allen, the current President of the Botanical Society of the British Isles, supplied details of an alien bramble *Rubus elegantispinosus* apparently wild near the British Museum. Mr Hastings had the alien grass *Festuca longifolia* identified from the Gunnersbury Triangle. I found a quantity of round-leaved cranesbill *Geranium rotundifolium* in a shrubbery in South Kensington.

V.C. 24, Bucks

Our first v.c. 24 record of the same increasing *Geranium*, found at Wraysbury Gravel-Pit by Mr Hastings, is the only 1986 record received from the small part of this vice-county in the London area.

References

GRIFFITH, D. 1986. The flora of Totteridge and its neighbourhood. *Lond. Nat.* **65**: 47-64.

JERMYN, S. T. 1974. *The Flora of Essex*. Essex Naturalists' Trust, Colchester.

PLANT, C. W., HARRIS, G. J., KIRBY, P., HYMAN, P. S., and LAMBERT, S. J. 1985. Biological recording in metropolitan Essex – a review of progress. *Lond. Nat.* **64**: 27-40.

WATSON, H. C. 1852. *Cybele Britannica* **3**. London.

Obituaries

EDWARD CHARLES WALLACE, 1909 – 1986

'Ted' Wallace – as he was known to everyone with whom he came into contact – was primarily a bryologist, but was overall an outstanding field botanist with a very good knowledge of flowering plants, ferns and lichens.

He helped many a young person who was attempting to obtain a working knowledge of the British flora by inviting him or her to join the small informal groups of botanists he encouraged into the field in the home counties and by sending them generous numbers of his duplicate moss packets to stimulate their interest. He was very single minded and considered any time not spent on plants or his other interests to be wasted.

Ted joined the L.N.H.S. in 1947 and acted as leader for many excursion for us and other societies and was always ready to join any group going into the field at weekends. After he retired he would also grasp an opportunity to go during the week as long as he could reach the meeting place by train or bus because he never learnt to drive. He enjoyed visiting the Cryptogamic Herbarium at the Natural History Museum about once a week in his later years. He was an excellent correspondent and very economical with words, but one might not always be able to decipher all of them!

Ted was born in London on the 12 February 1909 and died in Sutton on the 23 July 1986. He was a bachelor and lived in the same house in Sutton for most of his life. He worked for over forty years with W. H. Smith and Son at their London office which gave him plenty of free time to work on his plant and stamp collections. He used his holidays to the full by attending most British Bryological Society field meetings and exploring many parts of Scotland and occasionally visiting parts of the Continent. After he took early retirement in 1972 he travelled very widely in many parts of the world, meeting bryologists with whom he had corresponded for many years and adding to his collection.

He was Honorary Secretary of the B.B.S. for eleven years (1948-59) and carried much of the burden of that Society's organization and correspondence as well as the membership during those critical years. He was President of the Society from 1968-69.

Ted also held several offices in the Botanical Society of the British Isles.

His published work was mostly in the form of short papers on bryophytes. He was responsible for making and writing up several discoveries of mosses new to Britain, but his most notable publication was 'An Annotated List of British Mosses' compiled with Professor P. W. Richards and printed in the *Transactions of the British Bryological Society* in 1950.

Those wishing to read a more detailed account of Ted's life and bryological work should consult the excellent obituary by P. W. Richards in the *Journal of Bryology* **14**, Pt 3, 1987.

P. J. WANSTALL

BARBARA WELCH, 1904-1986

Barbara Welch died in a nursing home in Cheltenham in April 1986. She was born in Salisbury and moved to Richmond, Surrey, with her husband Brian in 1940. A member of the Wild Flower Society since 1922 and of the Botanical Society of the British Isles since 1928, she joined the L.N.H.S. in 1944. Although she still returned to Wiltshire and points further west for botanizing, obviously most of her field work was now carried out in the London area, chiefly in Surrey where she lived and in Middlesex where she worked with D. H. Kent.

In the 1950s Barbara was the L.N.H.S. Recorder for the London part of v.-c. 17 (Surrey) for the B.S.B.I. Map Recording Scheme. She was also Sectional

Librarian, a post she relinquished in 1961 to become a member of the Botany Committee for the next two years. Between the years 1949 and 1963 she contributed seven articles to *The London Naturalist*, either on her own or in conjunction with others. She was a major contributor to the Society's 'Handlist of the Plants of the London Area' by Kent and Lousley.

Barbara was a Branch Secretary of the W.F.S. for twenty-seven years and in 1953 was appointed Assistant Secretary of the B.S.B.I. It was in this capacity that she convened the inaugural meeting of the Surrey Flora Committee in 1957 at which meeting she was elected Secretary/Recorder. All the preliminary work for the 1976 *Flora of Surrey* by J. E. Lousley was carried out by Barbara, who was, of course, a major contributor to the publication. She was also a contributor to the floras of Essex, Gloucestershire, Middlesex and Wiltshire.

Barbara was an excellent field botanist and teacher although she did not suffer fools gladly. Under her somewhat brusque manner she was a very kind person and could be great fun. A field meeting led by her was always an enjoyable and instructive day and I will always be grateful for the amount she taught me.

In 1963 they moved to Cheltenham, for her husband had retired. After the move she lost all interest in field botany and became almost a recluse. This was a sad loss to her friends and to the world of botany. She was survived by her husband who died in March 1987.

J. E. Smith

HARRY ASHLEY TOOMBS, 1909 – 1987

Harry Toombs died in Pulborough, Sussex, in February this year. Harry's professional life was spent at the British Museum (Natural History), where he worked in the Palaeontology (formerly Geology) Department from 1928 to 1969. His chief scientific monuments are first, the fossil fish collection at the Museum, where his genius for orderliness ensured that the world's biggest is also the world's best organised and curated; and second, his techniques of acid preparation, developed with A. E. Rixon (1913-1983), which have revolutionised the study of vertebrate fossils.

Harry was born in Ealing, but the family soon moved to Harrow, where he was educated. Before gaining a place in the Museum, he worked for six months in an insurance office in Fleet Street, a situation he left without regret. On coming to the B.M. in 1928, Harry was soon assigned to fossil fishes, with Errol I. White C.B.E., F.R.S. (1901-1985). The two had first met on a Geologists' Association excursion to Harefield, led by White in May 1922, when Harry was only twelve. Their association must be almost a record, for it lasted over 65 years and has survived them both: a joint paper on British cephalaspids is now in press [23; numbers in square brackets refer to H.A.T.'s bibliography, below]. Within a few years, Harry was himself leading excursions of the Geologists' Association [2].

With Errol White, Toombs soon became deeply involved in the stratigraphy and fish faunas of the late Silurian and Old Red Sandstone of the Welsh borders. Several trips each year, alone or with White, were made to Herefordshire, Shropshire, or south Wales, prospecting and collecting fossils. His most remarkable discovery during these years was the lens of siltstone at Wayne Herbert, Herefordshire, which contained the first intact pteraspids ever found. The fossils from this lens were the basis of White's 1935 monograph on *Pteraspis*, and of several important papers on other remarkable fishes found in it.

During the 1939-45 war, Harry was seconded to the Geological Survey, to help with the urgent work of reviewing and listing sources of underground water supply [5,6]. At first he was based mainly in Yorkshire, and was in Hull when the city was blitzed; later he was back in London, and so was able to visit the Natural History Museum to lend a hand with clearing up and even mending the roof after the flying-bomb damage in 1944.

Back in the B.M. after the war, apart from clearing up and catching up, the trips to the Welsh borders and further afield were resumed with a new urgency. For the 18th International Geological Congress was to be held in Britain in 1948 (postponed from 1940), and the excursion programme included a two-week 'Vertebrate Palaeontology' tour of Britain, concentrating on the Welsh borders and on Scotland [8]. A most distinguished group of scientists booked this tour, and it is evident that the Directors (D. M. S. Watson, E. I. White and T. S. Westoll) and the Secretary (H. A. Toombs) saw in it the opportunity to demonstrate the 'Britain can take it' spirit, and to put on a show that everyone would remember. Harry's files show that 'Secretary' was hardly the appropriate title for the work and responsibility he carried in organising and conducting the excursion. He did everything, from negotiating the clearing of quarries unworked for a decade to arranging meals and accommodation, and finally packing and shipping the fossils collected by each participant. The letter of thanks to Harry from one of those participants, a French general, indicates how well he succeeded – 'cette excursion si merveilleusement organisée'.

Harry's experiments with acetic acid preparation of Devonian fishes, begun before the war, led in the immediate postwar years to refinements [7] and to the development of the 'transfer method' [10,12] in which the fossil is embedded in transparent plastic before the rock is removed with acid. The technique has revolutionised the study of small fossil vertebrates, and the two Toombs and Rixon papers [10,12] must be among the most widely cited in vertebrate palaeontology.

One of the earliest successful applications of Harry's acid techniques was to a few remarkable Devonian arthrodires from New South Wales (White 1952). In 1955, Harry set off for Australia to look for more. His five weeks alone in a remote 'shearer's shack' produced over 150 fishes, and this exploratory visit was followed up in 1963 by a much longer trip. Accompanied by his wife Lorna, Harry spent 16 weeks in the field in New South Wales, and then went to Western Australia for three weeks, following up the lead of a couple of fossils seen in Perth, where his ship had stopped for a day on the outward journey. The result of this short stay in Western Australia was the first major collection of fossils from the Gogo Formation, Devonian fishes and invertebrates which are as important as Harry's technical discoveries in the use of acids, for the two combined have produced 350-million-year-old skeletons which look as if the fishes were caught yesterday, and have made Gogo 'one of the most remarkable fossil fish sites in the world' (Ritchie 1985). In 1967, Harry took part in a major expedition to Gogo, jointly organised by the B.M. (N.H.), the Western Australian Museum, and the Hunterian Museum in Glasgow (Brunton, Miles and Rolfe 1969). The fossils from these expeditions are still yielding fruit, including the arthrodires *Toombsosteus* White, 1978, and *Harrytoombsia* Miles and Dennis 1979.

In 1969 Harry retired from the Museum with the rank of Chief Experimental Officer, a rare distinction that had been his for over a decade. He was very active in his union, the Institution of Professional Civil Servants, during the latter part of his career. He was an enthusiastic member of the Ludlow Research Group from its inception in 1952. He joined the Geologists' Association in 1927, and the London Natural History Society in 1945; almost immediately upon joining the latter he became General Secretary, an onerous job that he carried until 1955, when he was elected an Honorary Member. He was elected a Fellow of the Geological Society in 1954, and in 1958 became a Fellow of the Linnean Society *honoris causa,* a distinction limited to 25 people. Harry's publications are listed below. Many of us regret there were not more, for he was a storehouse of knowledge and wrote with an admirably lucid and easy style; but after his retirement the large garden in Pulborough was perhaps more compelling. His Fellowship of the Linnean led to his last publication [22], containing an anecdote about the bibliographer C. Davies Sherborn – 'Squire' – (1861-1942) that is worth repeating as a reminder of Harry's style and wit: 'When I first came to the Museum in 1928, I was installed in the Geology Library as the one and only Library assistant and I sat only a table away from the great man. He called to me with stentorian voice for help of all kinds and when eventually a miserly Museum grant brought him into the grasp of the Income Tax, he called in great wonderment, "Toombs!!! What do they mean by if nòné write noné??" (his mind being immersed in the Classics). I had to explain that there was a simple English negative word that had no significant classical allusion.'

In 1935 Harry married Lorna Townsend Hart who survives him. She was often his companion in the field, and he wrote of the 1963 Australian expedition 'as usual, she was the collector of many of our best specimens'. They had one daughter, Jennifer, now a Senior Clinical Medical Officer in Yorkshire.

Publications of H. A. Toombs:

1. 1934. The function of the local natural history society. *J. Wimbledon nat. Hist. Soc.* **2:** 26-29.
2. 1935. Field meeting at Leighton Buzzard, Bedfordshire. *Proc. Geol. Ass.* **46:** 432-436.
3. 1940a. The Gault at Leighton Buzzard. *SEast. Nat.* **44:** 62-63.
4. 1940b. Index. *In* Parker, T. J. and Haswell, W. A., *A Text-Book of Zoology,* Ed. 6. **Vol. 2,** revised by C. Forster-Cooper: 701-758. Macmillan, London.
5. 1942. [with K. P. Oakley and E. R. Bush] Water supply from underground sources. East Yorkshire – North Lincolnshire District. *Wartime Pamph. geol. Surv. Engl. Wales* **12** (2): 1-77.
6. 1944. [with K. P. Oakley and E. R. Bush] Water supply from underground sources. East Yorkshire – North Lincolnshire District. *Wartime Pamph. geol. Surv. Engl. Wales* **12** (1): 1-108.
7. 1948a. The use of acetic acid in the development of vertebrate fossils. *Museums J.* **48:** 54-55, pl. 7.
8. 1948b. [with E. I. White] Vertebrate Palaeontology. II. England and Wales. *Guide to Excursion C. 16, International Geological Congress, 18th Session (1948), London:* 4-14.
9. 1950a. [with A. E. Rixon] Correspondence. *Antiquity* **24:** 141.
10. 1950b. [with A. E. Rixon] The use of plastics in the 'transfer method' of preparing fossils. *Museums J.* **50:** 105-107, pl. 18.
11. 1952. A new section in the Piltdown Gravel. *SEast. Nat.* **57:** 31-33.
12. 1959. [with A. E. Rixon] The use of acids in the preparation of vertebrate fossils. *Curator* **2:** 304-312.
13. 1966a. [with G. Palmer] Pisces. *Zool. Rec.* **100** (for 1963), section 15: 1-98.
14. 1966b. [with G. Palmer] Pisces. *Zool. Rec.* **101** (for 1964), section 15: 1-106.
15. 1967a. The published works of Dr E. I. White, F.R.S. *J. Linn. Soc.* (Zool.) **47:** 1-4.
16. 1967b. [with G. Palmer] Pisces. *Zool. Rec.* **102** (for 1965), section 15: 1-118.
17. 1969. [with G. Palmer] Pisces. *Zool. Rec.* **103** (for 1966), section 15: 1-107.
18. 1970. [with G. Palmer, A. Proctor, D. Cole, R. S. Miles and C. Patterson] Pisces. *Zool. Rec.* **104** (for 1967), section 15: 1-163.
19. 1972. [with E. I. White] The buchanosteid arthrodires of Australia. *Bull. Br. Mus. nat. Hist.* (Geol.) **22:** 377-419, 9 pls.
20. 1973. Cyril Philip Castell [Obituary]. *Proc. Geol. Ass.* **84:** 111-113.
21. 1983. [with E. I. White] The cephalaspids from the Dittonian section at Cwm Mill, near Abergavenny, Gwent. *Bull. Br. Mus. nat. Hist.* (Geol.) **37:** 149-171.
22. 1986. Correspondence. *The Linnean* **2:** 18-19.
23. In press [with E. I. White and P. L. Forey] Osteostracans from four standard sections in the Anglo-Welsh borderland. *Bull. Br. Mus. nat. Hist.* (Geol.).

References

BRUNTON, C. H. C., MILES, R. S. and ROLFE, W. D. I. 1969. Gogo expedition 1967. *Proc. geol. Soc.* 1655: 79-83.

RITCHIE, A. 1985. The Gogo fish. *In Kadimakara: Extinct Vertebrates of Australia* (P. V. Rich and G. F. van Tets, eds): 102-108. Pioneer Design Studio, Lilydale, Victoria.

WHITE, E. I. 1952. Australian arthrodires. *Bull. Br. Mus. nat. Hist.* (Geol.) **1:** 249-304, pls 26-31.

Colin Patterson

for the year ended 30 June 1986

8 Months to 30.6.85 £	Income	£	£	£
	Income from members and supporters:			
6,759	Subscriptions		7,038	
87	Entrance fees		74	
203	Donations		469	
460	Tax recovered on covenanted subscriptions		551	
7,509				8,132
812	**Sales:** Journals	843		
(100)	*Less:* Expenses	(100)		
			743	
28	Bulletin subscriptions		22	
—	Literature and surplus library stock		197	
43	Journal offprints		32	
501	*Flora of the London Area*	389		
(15)	*Less:* Expenses	(51)	338	
29	*Atlas of Breeding Birds of the London Area* (including royalties)		—	
1,298				1,332
	Income from investments and deposits:			
5,890	Stocks and shares		10,562	
1,749	Tax recoverable 1985/86	4,422		
	1986/87	968		
			5,390	
1	Investment cash account		60	
20,632	Profit on sale of investments		4,484	
			20,496	
(2,238)	*Less:* Custodian's charges		(2,167)	
			18,329	
1,054	National Savings Bank and Charities Deposit Fund		1,031	
150	Bank deposit account		211	
27,238				19,571
36,045	**Total Income**			29,035
(7,172)	*Less:* **Expenditure**			(20,855)
£28,873	Surplus for the year			£8,180

8 Months to 30.6.85 £	£	Expenditure	£	£
		Meeting costs, sectional and general expenditure:		
1,127		Hire of halls and rooms	1,388	
1,151		Lecturers' fees and expenses, sectional expenses, etc	1,145	
145		Postage and telephone	151	
36		Stationery	108	
537		Services (Auditors' fees, insurance, etc.)	724	
200		Honoraria and expense allowances	1,018	
90		Equipment repairs and renewals	12	
—		Depreciation	2,360	
3,286				6,906
		Publications		
		Printing and expenses		
	4,359	*London Naturalist* **64**, Dec. 1985	3,562	
	2,895	*London Bird Report* **49**, published Oct. 1985	3,729	
	7,254			
	(6,700)	*Less:* Provision 1984	—	
554			7,291	
492		*Programme* and *Rules*	923	
171		*Bulletin* and *Newsletters*	333	
1,257		Mailing	1,652	
2,474				10,199
414		Library		625
268		Publicity		279
		Grants, including contributions to other organisations		
50		Research	—	
—		Bat project	2,496	
—		Other	350	
				2,846
680		Provision for current liabilities		—
£7,172		Total expenditure for the year		£20,855

Balance Sheet as at 30 June 1986

1985 £	1985 £		£	£
		Fixed Assets acquired after 30 June 1985, excluding library books:		
		Computers, including ancillary equipment and initial programming costs	10,342	
		Library equipment	143	
		Other indoor equipment	906	
		Bat detectors	413	
			11,804	
—		*Less:* Depreciation	(2,360)	9,444
143,857		*Quoted Investments* at cost (Market value £274,779 – 1985: £237,493)		150,613
		Current Assets		
		Funds at bank and on deposit:		
	6,909	National Westminster Bank plc	1,487	
	—	Charities Deposit Fund	1,050	
	8,361	National Savings Bank Investment Account	1,224	
	15,270		3,761	
	89	Cash in hand	173	
	—	Grant repayable and other payments in advance	2,586	
	—	Tax recoverable on investment income	968	
	—	Stationery stocks	470	
15,359				7,958
		Less: Current Liabilities		
	2,238	Custodian's charges	2,644	
	75	Contributions to tern raft and bat boxes	100	
	809	General liabilities and accrued expenditure	997	
(3,122)				(3,741)
£156,094		Total net assets		£164,274
		Representing: *General Fund* (incorporating the Hindson and Castell Bequests)		
127,122		Balance at 30 June 1985		156,094
99		Specific funds transferred		—
28,873		Surplus for the year		8,180
£156,094				£164,274

C. W. PLANT President
J. H. SAND Treasurer
Dated: 15 October 1986

Report of the Auditors to the Members of the London Natural History Society

We have audited the attached financial statements in accordance with approved auditing standards.

In our opinion these statements give a true and fair view of the income and expenditure of the Society for the year ended 30 June 1986 and of its assets, liabilities and fund balances at that date.

4 London Wall Buildings
LONDON EC2M 5NT
15 October 1986

FRASER KEEN
Chartered Accountants

Note to the Accounts

Accounting Policies

In previous years the accounts were prepared on a receipts and payments basis.

With effect from the year ended 30 June 1986, the accounts are prepared on an accruals basis. Provision is made for all material debtors and prepayments and creditors and accruals with the exception noted below.

However, subscriptions, which are collected on a calendar year basis, continue to be brought in as received and all 1986 subscriptions have been taken to income in these accounts.

The Society's Recording Areas Overlay

by KEITH H. HYATT

Editor, *The London Naturalist*

This is the sixth of a series of overlays to be published by the London Natural History Society for use with distribution and other recording maps when these are reproduced in our own publications at (preferably) the same scale.

The series was started by Sandford (1972) who introduced the revised recording map of the London Area in the form of a polygon based on the two-kilometre divisions of the National Grid and circumscribed on our established recording circle of 20-mile radius from St Paul's Cathedral.

So far the following overlays have been produced: 1 – Annual Rainfall (*Lond. Nat.* **51,** 1972), 2 – Master Grid (*L.N.* **52,** 1973), 3 – Habitat (*L.N.* **54,** 1975), 4 – Regolith (*L.N.* **56,** 1977) and 5 – Air Pollution (*L.N.* **58,** 1979). A pocket was provided in the back cover of *L.N.* **52** for their storage.

These overlays can be used in conjunction with a considerable number of papers in *The London Naturalist* and the *London Bird Report* and also in *The Flora of the London Area* (published by the Society in 1983), although through an error in reproduction the species distribution maps in the *Flora* are slightly smaller than was intended and the overlays need to be moved about slightly to compensate for this. Distribution maps that have been published at a scale different from the series of overlays can be used by making enlarged or reduced copies to fit the overlay or by viewing them on an optical enlarger/reducer.

The latest overlay, included with this issue of *The London Naturalist* and reproduced in Figure 1, shows the Society's Inner London area, the London County Council area, the Greater London area and the Watsonian Vice-county boundaries. The L.C.C. area is included as the pre-1974 national boundary revisions are, with a few 'tidying-up' modifications in London, used by the British Arachnological Society for recording spiders and other macro-Arachnida. The London Postal Districts area, which was used by Savory and Le Gros (1957) for 'The Arachnida of London', is not shown on the overlay for, although this area is substantially larger than the L.C.C. area north of the Thames and in the Croydon and Wimbledon areas south of the Thames, Savory and Le Gros did in fact only include one spider record from outside the L.C.C. area. This species is now recorded by Milner in central London (see p. 103 of this issue). Greater London as we know it today has the same boundary as the former Greater London Council and is also the area of operation of the Greater London Ecology Unit and the London Wildlife Trust. The Watsonian Vice-counties are the survey areas adhered to by the national plant recording schemes and our own Botany Section.

Acknowledgements

I am grateful to the Society's Mapping Schemes Secretary, Dr H. A. Sandford, for his constructive comments and to John Bennett, Rodney Burton, Edward Milner and Colin Plant for valuable suggestions.

References

SANDFORD, H. A. 1972. Recording maps and overlays. *Lond. Nat.* **51:** 20-21.
SAVORY, T. H. and LE GROS, A. E. 1957. The Arachnida of London. *Lond. Nat.* **36:** 41-50.

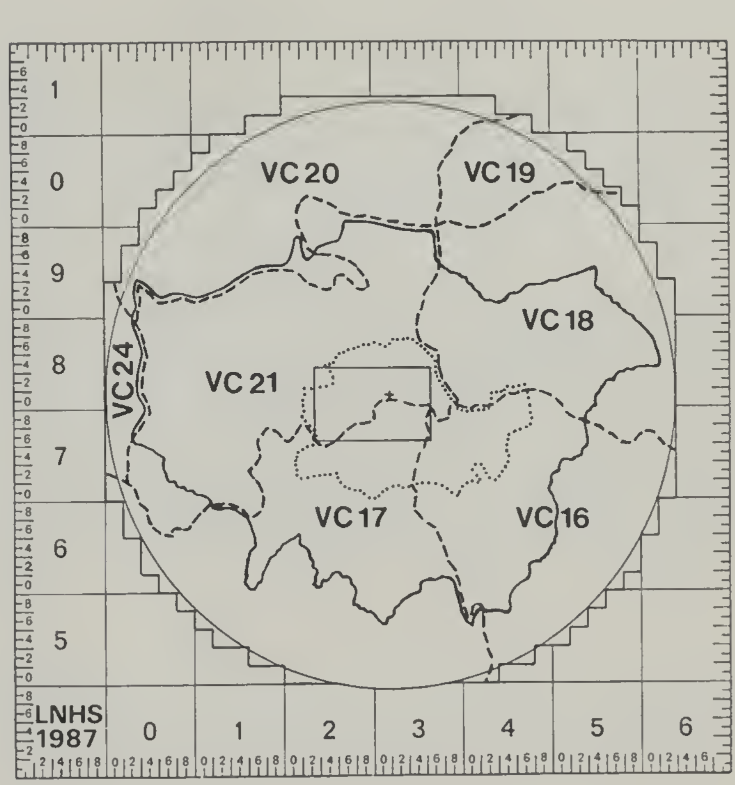
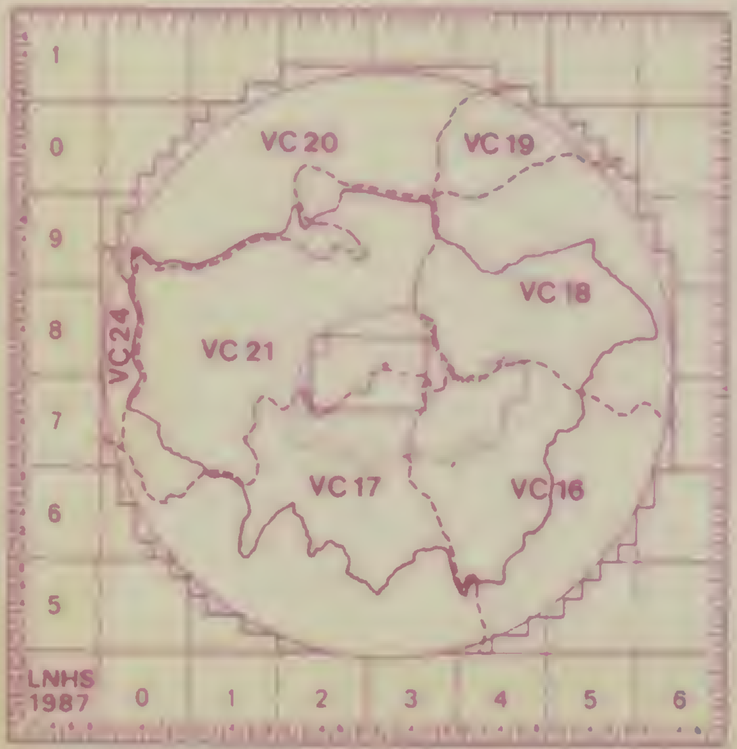


Fig. 1. The Society's Recording Areas. ······ London County Council area, ——— Greater London area, – – – – Watsonian Vice-counties – VC 16 West Kent, VC 17 Surrey. VC 18 South Essex, VC 19 North Essex, VC 20 Herts. VC 21 Middlesex, VC 24 Bucks. The central rectangle shows the Society's Inner London area with St Paul's Cathedral marked by a cross.

THE SOCIETY'S RECORDING AREAS



London County Council area

Greater London area

Watsonian Vice-counties – VC 16 West Kent, VC 17 Surrey, VC 18 South Essex, VC 19 North Essex, VC 20 Herts, VC 21 Middlesex, VC 24 Bucks. The central rectangle shows the Society's Inner London area with St Paul's Cathedral marked by a cross.

The London Naturalist

Instructions to contributors

Submission of papers

Papers relevant to the natural history and archaeology of the London Area should be submitted to the editor, Mr K. H. Hyatt, Department of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD, before the end of January if they are to be considered for publication in the same year. They should be typed, with double spacing and wide (three cm) margins, on one side of the paper. Authors must retain a duplicate copy. Papers should include at the beginning an abstract, summary, or synopsis.

Text

Locality spellings should follow the latest editions of the maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials, and scientific names must be underlined. When both common and Latin names are given there should be no brackets or commas separating them. Genus names should appear in full where first used within each paragraph. When scientific names are taken from a standard work, which must be cited, authorities should be omitted. In descriptive matter numbers under 10 should be in words, except in a strictly numerical context. Dates should follow the logical sequence of day, months, year (i.e. 25 December 1971). Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs or St. Lists should be in natural, alphabetical or numerical order.

References

Reference citation should be based on the Madison rules (in *Bull. Torrey bot. Club* **22:** 130-132 (1895)), except that a colon should always precede a page number. Capitalization in titles of papers in journals should be kept to a minimum. Journal titles should follow the abbreviations in the *World List of Scientific Periodicals* and be underlined. Examples are as follows:

In text:

Meadows (1970 : 80) or (Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964-9. *Lond. Nat.* **49:** 76-81.

MELLANBY, K. 1970. *Pesticides and Pollution.* Ed. 2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92:** 39-45.

Illustrations

Distribution maps should be submitted in the form of a Recording Map with symbols in Indian ink or Letraset. Solid dots are used to indicate contemporary or recent presence, circles for old records and crosses (not pluses) for other information, such as introduced species. Tetrad dots and circles should be 4.0 mm and tetrad crosses 5.0 mm, with a line thickness of 0.8 mm; all monad symbols should be 1.6 mm with a line thickness 0.5 mm. The caption should be written outside the frame of the map and will be set up by the printer. The Mapping Schemes Secretary can provide Recording Maps, advice and dies for printing distribution symbols.

Line drawings should be in Indian ink on white card, larger than the printed size. Place names, etc., must be produced with stencils or Letraset. Captions should be separate as they will be set up by the printer.

Photographs should be glossy black-and-white prints, of good contrast, preferably half-plate in size.

Proofs

Proofs will be sent to authors for scrutiny, but only essential corrections can be made at that stage.

Reprints

Up to 25 free reprints will be supplied on request. Additional copies may be purchased if ordered when the proofs are returned.

The London Naturalist

No. 66 **1987**

Northern Bat and Leisler's Bat .... *Frontispiece*

Officers for 1987 3

The Society's Recorders 4

Report of the Society for 1986 6

PLANT, COLIN W. — Recording London's wildlife 7

LEYTON, R. L. — Past conservation and management in Epping Forest 13

FERRIDAY, NIC — The field layer of Perivale Wood 23

WILLIAMS, L. R., MCLAUCHLIN, J. and HARRISON, T. G. — Hedgerows surviving in suburban Kingsbury 35

MICKLEBURGH, SIMON — Distribution and status of bats in the London area 41

TEAGLE, W. G. — Some observations on the fauna and flora of Nine Elms, Battersea, before the development of London's New Covent Garden Market 92

MILNER, J. E. D. — A new list of spiders found in London 101

MILNER, J. E. D. — Spiders in Alexandra Park 1984-7 111

MURDOCH, DAVID, LYLE, TERRY and HOLMES, M. J. G. — The butterflies of London's East End: a three-year survey 125

PLANT, COLIN W. — A review of the Lepidoptera of the London area for 1985 and 1986 135

Survey of Bookham Common: Forty-fifth year Progress report for 1986 157

DAY, RUTH — Population dynamics of damselflies at Bookham Common 167

BURTON, R. M. — Botanical records for 1986 185

Obituaries:
  EDWARD CHARLES WALLACE, 1909-1986 190
  BARBARA WELCH, 1904-1986 190
  HARRY ASHLEY TOOMBS, 1909-1987 191

Income and expenditure account for the year ended 30 June 1986 194

HYATT, KEITH H. — The Society's recording areas overlay 196

Book reviews 12, 21, 22, 33, 34, 40, 91, 110, 134, 156, 166

© London Natural History Society 1987

c/o British Museum (Natural History), Cromwell Road,
London SW7 5BD

Published November 1987

Riley Dunn & Wilson Ltd
EXPERT CONSERVATORS & BOOKBINDERS